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ABSTRACT

This catalog contains lesson descriptions of the available biology lessons on PLATO IV, compiled to assist instructors in planning their curricula. Information is provided for 87 lessons in the following areas: introductory material on experimental tools and techniques; chemical basis of life; cellular structure and function; reproduction and development; molecular genetics; biogenetics; classical genetics and genetics of populations; evolution; population biology and ecology; plant anatomy and physiology; plant pathology; taxonomy; human anatomy and physiology; and animal behavior. For each lesson, the following are provided: file name, author, instructional objective, description, student time, grade level, subject area, and special notes. (MH)

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COMMUNITY COLLEGE

BIOLOGY LESSON INDEX

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SE 020 916

AUGUST, 1975

COMMUNITY COLLEGE BIOLOGY LESSON INDEX

COMPILED BY MARY MANTEUFFEL

REVISED BY KATHIE HERRICK

Computer-based Education Research Laboratory

University of Illinois Urbana Illinois

AUGUST, 1975

COMMUNITY COLLEGE
BIOLOGY LESSON INDEX

COMPILED BY

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KATHIE HERRICK

COMPUTER-BASED EDUCATION RESEARCH LABORATORY

UNIVERSITY OF ILLINOIS

URBANA-CHAMPAIGN

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TABLE OF CONTENTS

This Catalog 1

Community College — Biology . . . 1

Biology Lesson Authors 3

Biology Index 5

Lesson Descriptions 11

THIS CATALOG

This catalog contains lesson descriptions of the available biology lessons on PLATO IV. It was compiled to assist instructors in planning their curricula. The instructor should use this as a guideline of which lessons might be useful in his course and then the individual lesson should be reviewed on PLATO. It is essential that the instructors be familiar with the lesson prior to student usage in order to assist students who have problems.

The PLATO lesson "bioindex" is an index in which all the biology lessons can be accessed. Each author maintains the privilege of editing his lesson at any time and is individually responsible for its operational quality as well as the effectiveness of its pedagogical design and accuracy of the subject matter content.

Your comments and suggestions about existing lessons or ideas about new lessons are welcome. To leave a comment, press -LAB- on the title page of "bioindex" or contact the community college biology coordinators, Kathie Herrick (herrick of biocc) or Steve Boggs (boggs of biocc), CERL, 252 Engineering Research Laboratory, University of Illinois, Urbana, Illinois 61801, (217) 333-7450.

COMMUNITY COLLEGE PROJECT -- BIOLOGY

The Community College Biology Group is currently engaged in validation of biology lesson materials. The lessons in this catalog are being field-tested at Kennedy-King College, Malcolm X College, and Wilbur Wright College. The field test focuses on the pedagogical effectiveness of the lessons, and may indicate a need for revisions of the lesson material. It is the responsibility of the Community College Biology Group at CERL, Urbana, to collect and interpret formative data on the lessons and to communicate the results to the individual authors. In addition, development of new lesson material by the Biology Group and community college biology instructors is underway.

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BIOLOGY INDEX

(revised 8/20/75)

1. Introductory Material, Experimental Tools and Techniques
   a. Introduction to PLATO Keyset
      (by D. Kane)
   b. Tools Used in Biology--Log Scales, Metric System and Chi Square Analysis
      (by R. Baillie and G. Hyatt)
   c. Review of Logs and Exponents
      (by R. Francis, S. Kaplan, and D. Burke)
   d. Exponential Growth Formulas
      (by R. Francis, S. Kaplan, and D. Burke)
   e. Graphing Exponential Cell Growth Data
      (by R. Francis, S. Kaplan, and D. Burke)
   f. A Tool: The Spectrophotometer
      (by G. May)
   g. Experimental Technique
      (by A. Haney and G. May)
   h. Life in a Microcosm
      (by A. Haney and G. May)
   i. Serial Dilutions
      (by B. Virdrine)

2. Chemical Basis of Life

   2 lessons temporarily unavailable

3. Cellular Structure and Function
   a. The Ultrastructural Concept (M)*
      (by J. Cooper and G. Hyatt)
   b. Cells--Structure and Function
      (by R. Crockett and R. Crockett)
   c. Diffusion and Osmosis
      (by S. Boggs)
   d. Introduction to Water Relations
      (by J. Silvius)
   e. Water Relations Laboratory
      (by J. Silvius)
   f. Surface Area/Volume in Living Systems
      (by R. Arsenty)
   g. Cell Growth
      (by R. Francis, S. Kaplan, and D. Burke)

*(M) indicates that a microfiche is required.

4. Reproduction and Development

   a. Mitotic Cell Division
      (by J. Lendway)

   b. Mitosis
      (by L. Porch)

   c. Meiosis
      (by R. Arsenty)

   d. Embryology
      (by C. Matz)

   e. Plant Life Cycles (M)
      (by A. Haney and G. May)

   f. Hormonal Control of the Menstrual Cycle (see 13c)
      (by L. Porch, M. Manteuffel, and S. Boggs)

5. Molecular Genetics: The Nature of the Gene and Its Action

   a. DNA and Protein Synthesis
      (by P. Tenczar and R. Baillie)

   b. DNA, RNA and Protein Synthesis
      (by R. Arsenty)

6. Biogenetics: Enzymes and Metabolism

   a. Enzyme Experiments
      (by R. Baillie and G. Hyatt)

   b. Essentials of Photosynthesis
      (by R. Arsenty)

   c. Photosynthesis
      (by J. Noell and A. Haney)

   d. Experiments in Photosynthesis
      (by J. Noell)

   e. ATP, Anaerobic and Aerobic Respiration
      (by R. Arsenty)

   f. Election Transport Chain
      (by R. Arsenty)

   g. Measuring the Level of Life
      (by R. Arsenty)

   h. Respiration and Enzymes
      (by J. Silvius and G. May)

   i. Experiments in Respiration
      (by J. Silvius)

7. Classical Genetics and Genetics of Populations

   a. Vocabulary Drills for Genetics--Part I
      (by J. Lendway)

   b. Vocabulary Drills for Genetics--Part II
      (by J. Lendway)

7. (cont.)

   c. Elementary Probability and Mendel's Laws
      (by R. Baillie and G. Hyatt)

   d. Blood Typing
      (by L. Porch and M. Yamada)

   e. Genetics and Heredity
      (by R. Baillie, G. Hyatt, and J. Noell)

   f. Drosophila Genetics
      (by J. Denault, G. Hyatt, and D. Eades)

   g. Gene Mapping in Diploid Organisms
      (by K. Frank)

   h. Plant Genetics Problems
      (by J. Noell)

   i. Populations Genetics (Demonstration of Inbreeding)
      (by M. Grossman and D. Walter)

   j. Population Genetics (Hardy-Weinberg Principle)
      (by M. Grossman, D. Walter, and D. Chirolas)

   k. Population Genetics (Quantitative Genetics)
      (by M. Grossman, D. Walter, and D. Chirolas)

8. Evolution

   a. Natural Selection
      (by G. Hyatt)

   b. Natural Selection Experiment
      (by G. Hyatt)

   c. Comparative Serology
      (by G. Hyatt)

   d. Induced Mutations Experiment Using Aspergillus
      (by J. Noell)

   e. Plant Life Cycles--An Evolutionary Approach (see 4e)
      (by A. Haney and G. May)

   f. Population Genetics (Demonstration of Inbreeding) (see 7i)
      (by M. Grossman, and D. Walter)

   g. Population Genetics (Hardy-Weinberg Principle) (see 7j)
      (by M. Grossman, D. Walter, and D. Chirolas)

   h. Population Genetics (Quantitative Genetics) (see 7k)
      (by M. Grossman, D. Walter, and D. Chirolas)

9. Population Biology and Ecology

   a. Biogeochemical Cycles
      (by R. Baillie and G. Hyatt)

   b. Energy Relationships in Biological Systems
      (by R. Baillie and G. Hyatt)

9. (cont.)

   c. Predator-Prey Relationships
      (by R. Baillie and G. Hyatt)

   d. Buffalo--Animal Population Experiment
      (by C. Burson and T. Gordon)

   e. Population Dynamics
      (by S. Boggs)

   f. Populations Laboratory Using E. coli
      (by J. Noell)

   g. Stationary Phase of Cell Growth
      (by R. Francis, S. Kaplan and D. Burke)

   h. Lag Phase of Cell Growth
      (by R. Francis, S. Kaplan and D. Burke)

   i. Death Phase of Cell Growth
      (by R. Francis, S. Kaplan and D. Burke)

   j. Population Genetics--Demonstration of Inbreeding (see 7i)
      (by M. Grossman and D. Walter)

   k. Population Genetics--Hardy-Weinberg Principle (see 7j)
      (by M. Grossman, D. Walter and D. Chirolas)

   l. Population Genetics--Quantitative Genetics (see 7k)
      (by M. Grossman, D. Walter and D. Chirolas)

   m. Life in a Microcosm (see 1h)
      (by A. Haney and G. May)

10. Plant Anatomy and Physiology

   a. Seed Germination
      (by S. Wolniak)

   b. Plant Growth
      (by M. Manteuffel and J. Noell)

   c. Plant Responses and Apical Dominance
      (by M. Manteuffel and J. Noell)

   d. Flowering and Photoperiod
      (by J. Noell)

   e. Fruiting and Leaf Senescence
      (by J. Noell)

   f. Enzyme-Hormone Interactions
      (by J. Noell)

   g. Organization of the Higher Plant (M)
      (by A. Haney and G. May)

11. Plant Pathology

   a. Plant Pathology (M)
      (by J. Silvius)

12. Taxonomy

    a. Use of Taxonomic Keys
       (by J. Mehney)

    b. Plant Taxonomy (M)
       (by A. Haney)

    c. Tree Identification Quiz (M)
       (by A. Haney and G. May)

13. Human Anatomy and Physiology

    a. ADH and Water Balance in Humans
       (by R. Arsenty)

    b. Neuron Structure and Function
       (by S. Boggs)

    c. Hormonal Control of the Menstrual Cycle
       (by L. Porch)

    d. Human Digestive System
       (by S. Boggs)

    e. Cardiac Cycle
       (by F. Bomer)

    f. Heart Rate Regulatory Mechanisms
       (by F. Bomer)

    g. The Mechanics of Breathing
       (by F. Bomer)

    h. Elementary Psycho-physiology of Audition
       (by M. Moore and P. McClintock)

14. Animal Behavior

    a. Physiological Basis of Learning
       (by S. Boggs)

    b. Simple Animal Behavior--Klinokinesis
       (by G. Hyatt)

    c. Social Behavior of Birds
       (by G. Hyatt)

1. File Name: bioindex-1a ecs: 3963
   Introduction to the PLATO Keyset

2. Author: D. Kane

3. Instructional Objective: To learn to use those PLATO keyboard operations often required in lessons.

4. Description: Index (accessible through TERM-index*)

   0) Introduction
   1) NEXT key
   2) Arrows
   3) ERASE key
   4) EDIT key
   5) Keyboard (letters and numbers)
   6) SHIFT key (capital letters, etc.)
   7) MICRO key
   8) Operators (+, -, ×, ÷, /)
   9) SUPER and SUB keys (exponents)
   10) HELP, DATA, BACK, LAB keys
   11) TERM key
   12) To go on with today's material

5. Student Time: 15 minutes

6. Grade Level and Subject Area: Science students

7. Special Notes: The student can either review the entire lesson or selectively examine parts with which he is unfamiliar.

*While holding the SHIFT key down, press the TERM ANS key, then type in the word "index".

1. File Name: bioindex-1b ecs: 7334
   Tools Used in Biology — Log Scales, Metric System, and Chi-Square Analysis

2. Authors: R. Baillie and G. Hyatt

3. Instructional Objective: To manipulate log scales, the metric system, and chi-square analysis for biological problems.

4. Description: Index (accessible through TERM-index)

   1) Graphing with semilog and log-log scales
      a. Why use log scales?
      b. Linear scales vs log scales
      c. Graphing bacterial growth on semilog graph
   2) The Metric System
      a. Length -- meters
         1. What is the length on the line in cm.?
         2. Conversion between metric units -- problems
      b. Volume -- liters
      c. Weight — grams
      d. Sample Problems
   3) Chi Square Distribution
      a. Introduction to X^2
      b. Enter values in a X^2 table to perform a X^2 analysis on your data

5. Student Time: 1 hour

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: This lesson covers some basic tools used in biology that are often confusing to the student. It can be used as a lecture-lab supplement or as a review for students who require additional assistance in one or more of these topics.

1. File Name: bioindex-1c ecs: 3100
   Review of Logs and Exponents

2. Authors: R. Francis with S. Kaplan and D. Burke

3. Instructional Objectives: To learn about exponents and logarithms in order to

   1) understand what a logarithm is
   2) find the logarithm of a number
   3) read a semilog graph
   4) follow the transformation of

$$N_n = N_0 2^n \quad \text{into} \quad \frac{\log_{10}\left[\frac{N_n}{N_0}\right]}{.301} = n$$

4. Description: No index

   1) Option to take the pre-test -- if passed go to item #10 of this lesson
   2) If option not accepted or pre-test failed, do the following items
   3) Definition of exponent, base
   4) Define multiplication = addition of exponent
   5) Definition of logarithm = fractional exponent
   6) Reading a log table
   7) Drill on finding logs
   8) Logs of numbers greater than 10
   9) Special cases: e.g., log of 1, $\log_n N$, etc.
   10) Rearranging $N_n = N_0 2^n$ into $\frac{\log_{10}\left[\frac{N_n}{N_0}\right]}{.301} = n$

5. Student Time: 15 minutes plus 20 - 25 minutes for log review

6. Grade Level and Subject Area: Introductory Microbiology

7. Special Notes: This is the second in a series of seven lessons on the phases of cell growth with particular attention to graphical analysis.

1. File Name: bioindex-1d ecs: 3041
   Exponential Growth Formulas

2. Authors: R. Francis with S. Kaplan and D. Burke

3. Instructional Objectives: To compute growth rate and generation time and gain a qualitative feeling for typical values.
   To read and describe the relationship of semilog graphs to linear graphs.
   To define the meaning of slope on semilog and linear graphs.

4. Description: No index

   1) Semilog graph: relationship to linear graphs, reading the graph
   2) Relationship of $N_n = N_0 2^n$ and $\frac{\log_{10}\left[\frac{N_n}{N_0}\right]}{.301} = n$ to the semilog and linear graphs of exponential growth
   3) Solving the equation $\frac{\log_{10}\left[\frac{N_n}{N_0}\right]}{.301} = n$ for generation time, growth rate, doubling time, and practice with computation
   4) Plotting of growth curves for student supplied generation times and growth rate constants
   5) Matching tests on symbols, definitions and formulas
   6) Meaning of slope on semilog and linear graphs

5. Student Time: 25 - 65 minutes

6. Grade Level and Subject Area: Introductory Microbiology

7. Special Notes: This is the third in a series of seven lessons on the phases of cell growth with particular attention to graphical analysis.

1. File Name: bioindex-le ecs: 3588
   Graphing Exponential Cell Growth Data

2. Authors: R. Francis with S. Kaplan and D. Burke

3. Instructional Objectives: To plot his/her own data, draw a growth curve and compute the growth rate.
   To deduce growth rate from cell population curves.
   To gain an intuitive feel for typical food spoilage problems.

4. Description: No index

   1) Student option to work growth rate problems with computer aid. If declined, go to item #2
      a. Student chooses graphing limits
      b. Plots his own or instructor supplied data
      c. Draws best straight line approximation
      d. Computes growth rate
   2) Given graph of cell population vs time, student determines cell growth rate vs time
   3) Student works two computer supplied problems to find how long typical foods will remain fresh under varying temperatures
      Student may work as many additional problems as he wishes given five organisms and five temperatures.

5. Student Time: 15 - 30 minutes for the graphing
   20 - 30 minutes for the remaining items

6. Grade Level and Subject Area: Introductory Microbiology

7. Special Notes: This is the fourth in a series of seven lessons on the phases of cell growth with particular attention to graphical analysis. Handout for Part 1.

1. File Name: bioindex-1f ecs: 1897
   A Tool: The Spectrophotometer

2. Author: G. May

3. Instructional Objectives: To explain the principle of spectrophotometer operation.
   To interpret data obtained from a spectrophotometer.

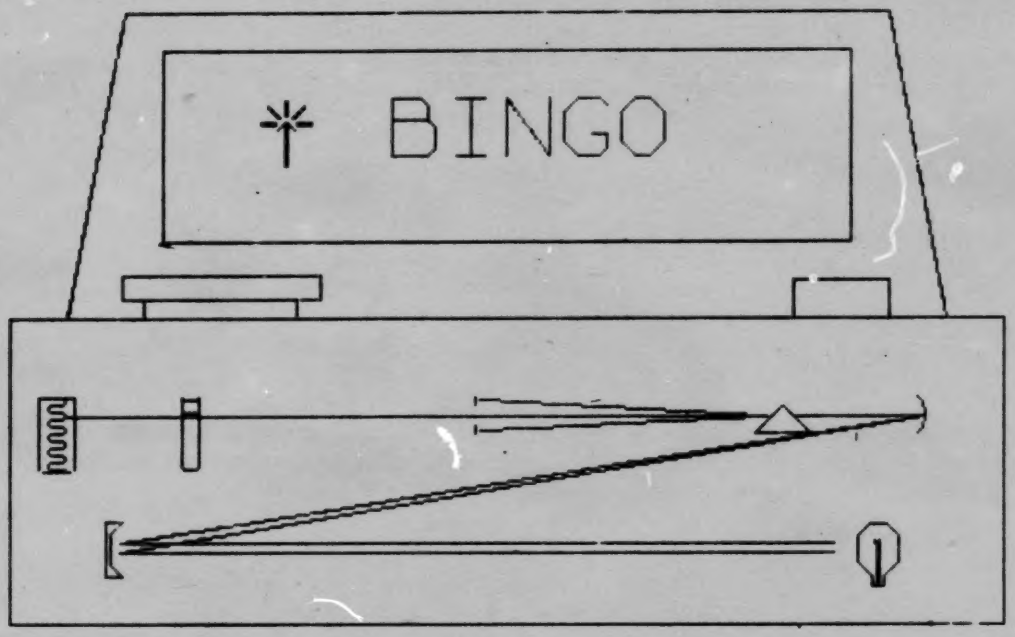
4. Description: No index initially accessible, areas designated can be reviewed through index seen at end by pressing BACK

   1) Color, light, absorbance, and transmittance -- illustrative examples and six questions
   2) The spectrophotometer — diagram, explanation of components
   3) The blank and the standard curve -- example, six questions

5. Student Time: 25 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: Good topic coverage, requires no introduction.



This is a schematic representation.of the Guts of a spectrophotometer.

19 To see the path that light traverses inside the spectrophotmeter, press NEXT!

1. File Name: bioindex-1g ecs: 2983
   Experimental Technique

2. Authors: A. Haney and G. May

3. Instructional Objectives: To learn the process of scientific inquiry.
   To analyze the steps in the process.
   To manipulate conversions between English and metric measure.

4. Description: Index: (accessible through TERM-index)

   1) Scientific inquiry
      a. Definition science
      b. Flow chart
      c. Example
   2) Setting up an experiment
      a. Choosing a hypothesis
      b. Using controls
   3) Observing an experiment--5 steps to follow
   4) Drawing proper conclusions--2 examples of hypotheses with experimental designs and results
   5) Conversions and extrapolation
      a. Metric conversion tables
      b. Sample problems

5. Student Time: 45 minutes

6. Grade Level and Subject Area: Introductory Biology or Botany

7. Special Notes: Good comprehensive coverage of subject area. There is a sequel lab (bioindex-1h) for practice in applying these principles.

1. File Name: bioindex-1h ecs: 4284
   Life in a Microcosm

2. Authors: A. Haney and G. May

3. Instructional Objectives: To evaluate hypotheses and experimental designs for their potential to yield a sound conclusion.
   To interpret results of research accurately taking above into consideration.

4. Description: Choose area for research:

   1) Competition between plants
      a. Choose hypothesis (3)
      b. Choose experimental design--2 for each hypothesis
      c. Make conclusion--(3)
      d. PLATO scores 1-10
   2) Effects of light on plant growth
      a. Choose hypothesis (3)
      b. Choose experimental design (2)
      c. Make conclusion (3)
      d. PLATO scores 1-10

5. Student Time: minimum 20 minutes
   depends on number of experiments conducted

6. Grade Level and Subject Area: Introductory Biology or Botany

7. Special Notes: Designed as a lab replacement.
   Very flexible for a variety of experimental combinations.
   PLATO evaluates and scores procedure (0-10 for each experiment). Minimum score of 20 must be obtained before lesson is completed.

1. File Name: bioindex-11 ecs: 1909
   Serial Dilutions

2. Author: B. Virdrine

3. Instructional Objective: To calculate concentrations and dilution factors.

4. Description: Index (accessible through TERM-index)

   values for each problem selected randomly from pool
   1) Introductory Problem Set--step-by-step explanation
   2) Problem Set 1 (a serial dilution)--9 questions
   3) Problem Set 2 (calculating concentrations, I)--minimum 2 questions: No. of colonies ÷ dilution factor
   4) Problem Set 3 (calculating concentrations, II)--minimum 2 questions
   5) Problem Set 4 (calculating the dilution factor)--minimum 2 questions: colony count ÷ concentration

   Evaluation at the end of each unit.
   Can redo each set with different values.

5. Student Time: 25 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Note: Drill exercise. Students must be familiar with the SUPER-script key.

1. File Name: bioindex-2a NOT FINISHED AS OF 8/25/75

1. File Name: bioindex-2b NOT FINISHED AS OF 8/25/75

1. File Name: bioindex-3a ecs: 4585
   The Ultrastructural Concept

2. Authors: J. Cooper and G. Hyatt

3. Instructional Objectives: To recognize the organelles of the "typical" cell.
   To explain functions of cell organelles and their contribution to the working of the whole cell.

4. Description: Introduction, index (accessible through DATA)

   1) The nucleus, nuclear membrane, nucleolus
   2) The cell membrane
   3) The cell wall
   4) The endoplasmic reticulum
   5) The golgi apparatus
   6) The mitochondrion
   7) The centriole
   8) The chloroplast
   9) Self-evaluation

5. Student Time: 45 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: Can be used with or without microfiche. Student interaction is high in the lesson due to frequent questioning.

1. File Name: bioindex-3b ecs: 3623
   Cells -- Structure and Function

2. Authors: R. Crockett and R. Crockett

3. Instructional Objective: To relate structure and function of cell organelles.

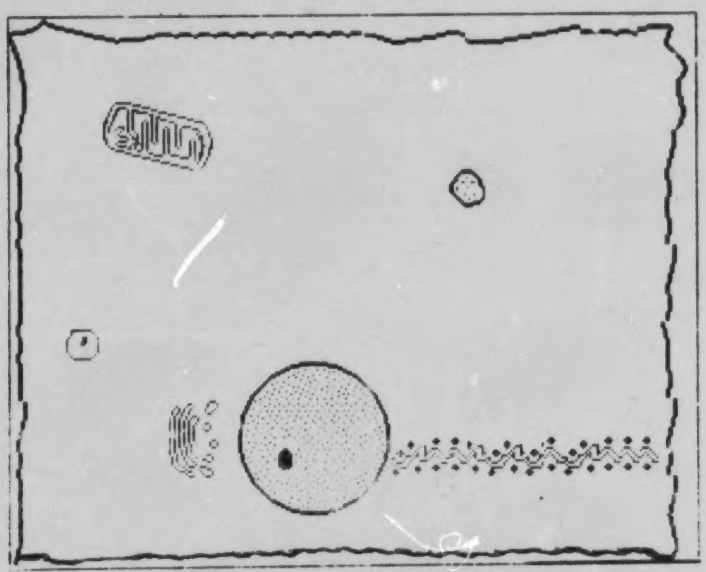
4. Description: Organelles only are indexed; may return only at end of segment

   1) History
   2) Introduction
   3) Cell structure (diagram and discussion)
      a. Plasma membrane
         1. Osmosis
         2. Phagocytosis and pinocytosis
         3. Active transport
      b. Nucleus and nucleolus
      c. E.R. and ribosomes
      d. Golgi apparatus
      e. Mitochondria
      f. Lysosomes
      g. Vacuoles
      h. Centrioles
      i. Plastids
      j. Cilia and flagella
      k. Cell wall
      l. To leave lesson

5. Student Time: 45 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: By choosing the individual letters from the index, the student assembles a cell and learns the function and structure of each item.



1. **File Name:** bioindex-3c ecs: 2848
   Diffusion and Osmosis

2. **Author:** S. Boggs

3. **Instructional Objectives:** To know the principles of molecular movement.
   To apply these principles to biological systems.

4. **Description:** No index display, can access *-ed areas by TERM-index

   1) Molecular motion
      *a. Diffusion -- definition, animation
      *b. Brownian
      c. Summary
   2) Osmosis
      *a. Semipermeable membrane -- diagram, animation
      b. Osmosis demonstration -- five questions (HELP from questions accesses * index)
      *c. Osmosis experiments -- U tube, red blood cells

5. **Student Time:** 30 minutes

6. **Grade Level and Subject Area:** Introductory Biology

7. **Special Notes:** This lesson is often used as a lab replacement. The animations and simulated experiments are particularly helpful in visualizing the concepts presented.

Manny Molecule takes a walk.
What's this?
He can't get through!

But here comes Wally Water!

To see an animation showing just how a semi-permeable membrane works, press NEXT.

1. File Name: bioindex-3d ecs: 1611
   Water Relations Laboratory

2. Author: J. Silvius

3. Instructional Objective: To discuss the factors that influence the direction of water movement across membranes.

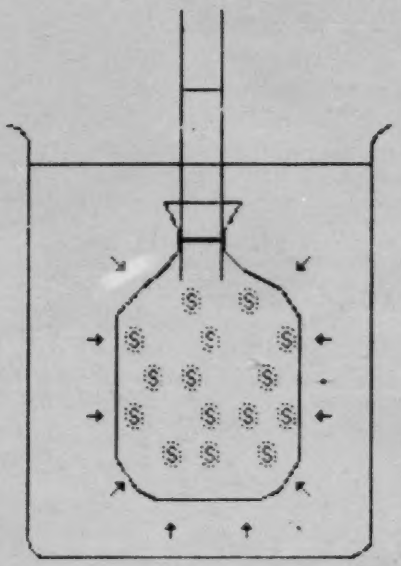
4. Description: No index

   1) Introduction
      a. Role of water in living systems
      b. Properties of water
   2) Factors affecting diffusion tendencies demonstrated with osmometer in animated sequence
      a. Solute
      b. Pressure
      c. Colloids
   3) Mathematical expression of components
   4) Choose hypothetical values of solute for algal cell, observe concentration and pressure effect -- two summary questions

5. Student Time: 15 minutes

6. Grade Level and Subject Area: Introductory Biology or Botany

7. Special Notes: Good introduction to topic. Designed as laboratory replacement.



1. File Name: bioindex-3e NOT READY AS OF 8/25/75

1. File Name: bioindex-3f ecs: 2502
   Surface Area: Volume in Living Systems

2. Author: R. Arsenty

3. Instructional Objectives: To discuss the importance of the ratio between surface area and volume in living organisms.
   To demonstrate this relationship using two examples, a cube and a sphere.

4. Description: Index (accessible through TERM-index)

   1) Surface area/volume (bioindex-3d)
      a. How long is an edge of the cube to be?
      b. What is the radius of the sphere to be?
      c. Questions
   2) Diffusion: osmosis (bioindex-3d)
   3) Both surface area/volume and diffusion: osmosis

5. Student Time: 15 - 25 minutes

6. Subject Area and Grade Level: Introductory Biology

7. Special Notes: If you elect to use both the "Surface Area/Volume" lesson and the "Diffusion and Osmosis" lesson, you need only place this lesson in your index. But if you wish students to see "Diffusion and Osmosis" alone, it can be accessed independently. There is a handout written to accompany this lesson, but it is not required. It consists of tables for recording data and a reiteration of information contained in the on-line lesson.

1. **File Name:** bioindex-3g
   Cell Growth
   ecs: 3303

2. **Authors:** R. Francis with S. Kaplan and D. Burke

3. **Instructional Objective:** To describe elementary concepts and terminology associated with exponential growth.

4. **Description:** No index

   1) Mother/daughter cells
   2) Doubling time
   3) Analysis of formula $N_n = N_0 2^n$
   4) Plotting exponential growth on linear coordinates

5. **Student Time:** 15 - 35 minutes

6. **Grade Level and Subject Area:** Introductory Microbiology

7. **Special Notes:** This is the first in a series of seven lessons on the phases of cell growth with particular attention to graphical analysis.

   TERM - index accesses index for remainder of series.
   1. Exponential or log phase
      2. Graphing growth (bioindex-1d, 1e)
      3. Exponents and logs (bioindex-1c)
      4. Semi-log graph (bioindex-1d)
      5. Slope (bioindex-1d)
      6. Plotting own data (bioindex-1d, 1e)
      7. Food problem (bioindex-1e)
   8. Stationary phase (bioindex-9g)
      9. Toxicity
      10. Linear
   11. Lag phase (bioindex-91)
   12. Death phase (bioindex-9h)

As you know a cell must carry out 3 basic life processes in order to survive. They must be able to:

1. Synthesize the various elements of living matter.
2. Produce and utilize energy
3. Reproduce exact copies of themselves (growth).

We look alike
We are paramecia!

1. File Name: bioindex-4a ecs: 3263
   Mitotic Cell Division

2. Author: J. Lendway

3. Instructional Objective: To identify the important occurrences in each phase of mitotic cell division.

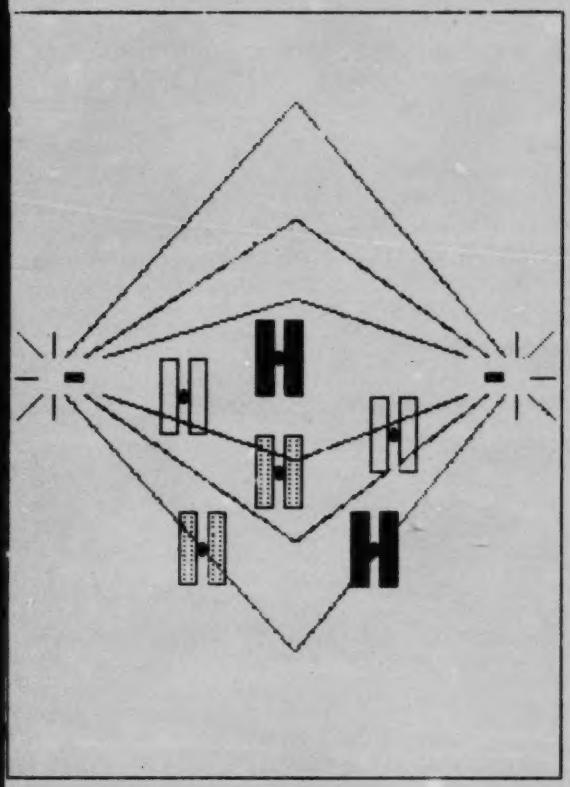
4. Description: No index

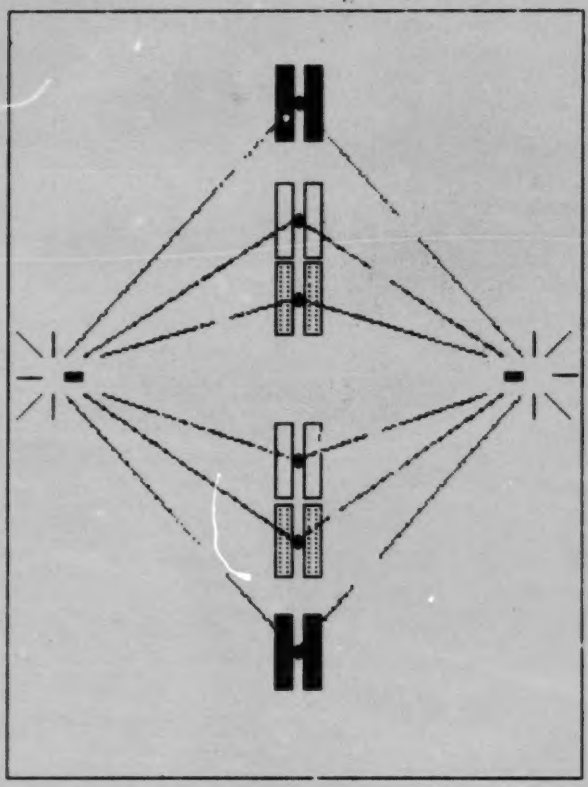
   1) Introduction
      a. Cytokinesis
      b. Karyokinesis
      c. Questions
   2) Outline of mitotic phases, what is accomplished in each, and questions
   3) Animation of the mitotic phases with discussion and questions accompanying each phase

5. Student Time: 30 - 40 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: This lesson is intended to be a thorough coverage of the subject and requires much student interaction.





1. File Name: bioindex-4b ecs: 5656
   Mitosis

2. Author: L. Porch
   revised by City Colleges of Chicago programmers

3. Instructional Objective: To explain the process of mitotic cell division.

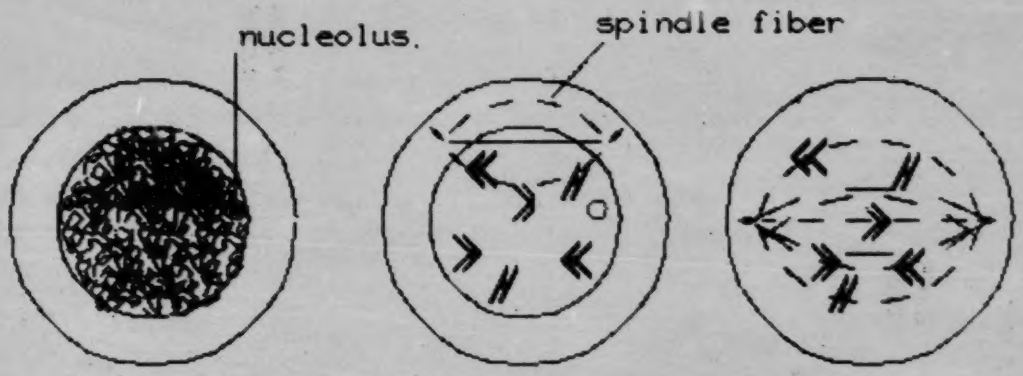
4. Description: Index (accessible through DATA)

   Branch -- DATA1 for diagram, LAB1 for description
   1) Introduction -- role of mitosis, two questions
   2) Interphase -- three questions about process
   3) Prophase -- six questions
   4) Metaphase -- three questions
   5) Anaphase -- two questions
   6) Quiz -- ten questions
   7) Data -- graphs of student performance in each of the above sections

5. Student Time: 45 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: Especially adapted for emphasizing sequential nature of process. Students should be encouraged to use branch sequences. Comprehensive evaluation at end of each unit.



early prophase middle prophase late prophase

Press -Next- to see the folowing phase of mitosis.
Press -Back- to see the previous phase of mitosis.
Press -Back1- to go back to the question .

1. File Name: bioindex-4c ecs: 3745
   Meiosis

2. Authors: R. Arsenty
   revised by M. Manteuffel and S. Boggs

3. Instructional Objective: To identify when, where, why, and how meiosis occurs.

4. Description: Index (accessible through TERM-index)

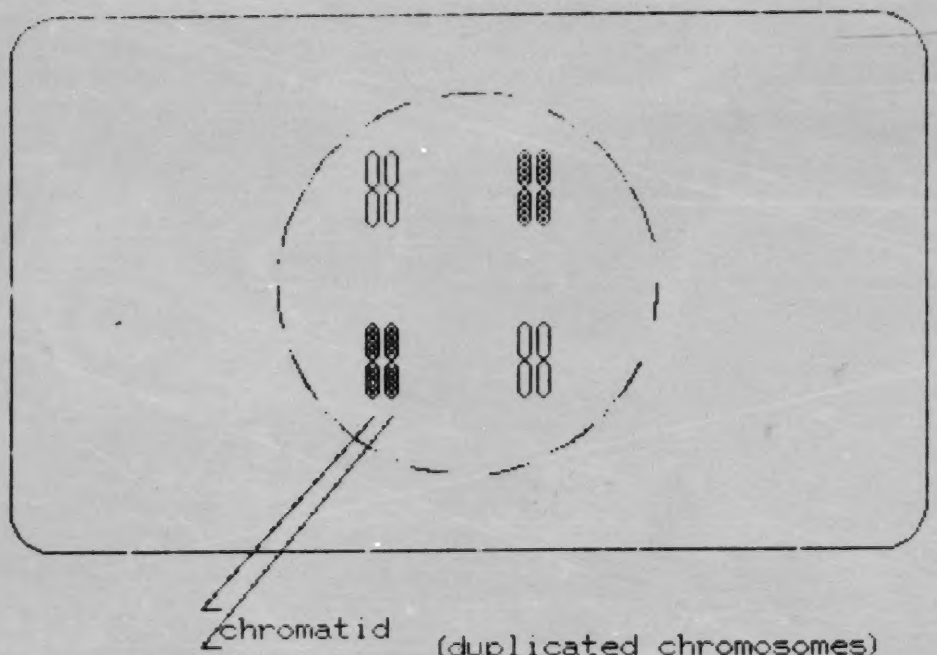
   1) Introduction
      a. Overview
      b. Lesson objectives
      c. Table of comparison of mitosis and meiosis -- questions

      Definitions accessible at end of Introduction via HELP.
   2) Meiosis I -- labelled diagrams, animation and discussion of phases, one question
   3) Meiosis II -- animation and discussion of phases
   4) Fertilization -- animation and discussion
   5) Seven review questions -- definitions accessible via HELP before quiz

5. Student Time: 45 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: This lesson was designed to utilize animations for emphasizing the continuity of the meiotic process. Presentation of lesson is such that student is not dependent on knowledge of terminology. However, animations are accompanied by detailed descriptions. Comprehensive topic coverage.



1. File Name: bioindex-4d ecs: 3968
   Embryonic Development in Animals

2. Author: C. Matz

3. Instructional Objectives: To describe development from the fertilized egg to formation of the three germ layers. To describe the major adult derivations of these three germ layers.

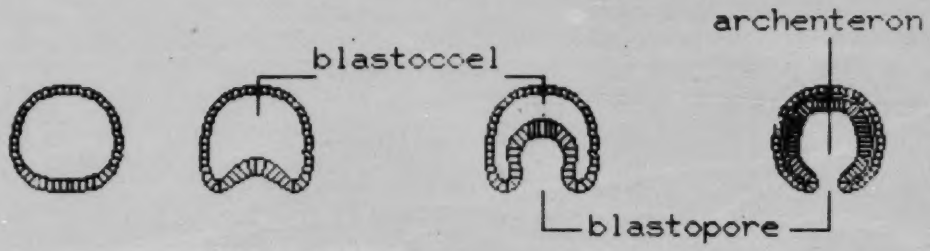
4. Description: Index (accessible through DATA)

   1) Introduction, five objectives, three pretest items evaluated
   2) Embryonic Development in Amphioxus
      a. Cleavage
      b. Blastulation
      c. Gastrulation -- includes animated sequence
      d. Formation of mesoderm
      e. Notochord formation, neural groove and tube -- eight questions, diagrams
   3) Posttest -- twenty questions
   4) Data on student performance

5. Student Time: 45 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: Comprehensive coverage for elementary presentation. Excellent supplement. Animation of gastrulation very helpful for envisioning process.



blastula blastula invaginating (gastrulation) gastrula

Press NEXT to see this process animated.

Early Stage Middle Stage Later Stage

35

TOP VIEW OF GASTRULA CROSS-SECTION AS MESODERM FORMS

1. File Name: bioindex-4e ecs: 7339
   Plant Life Cycles

2. Authors: A. Haney and G. May

3. Instructional Objectives: To construct a diagram of a generalized plato life cycle given the components. To discuss the relationship between gametophyte and sporophyte generations and how this relationship differs throughout the plant kingdom with special emphasis on evolutionary significance.

4. Description: Index (accessible only at end of each unit)

   1) Introduction
      a. Alternation of generations -- two forms, two processes
      b. Evolutionary requirements
      c. Meiosis
   2) Algae -- importance, representative slides (diatoms, Volvox, Ulothnix, Oedogonum, Spirogyra), diagram of simplified algal life cycle
   3) Bryophytes -- representative slides (Mnium, Polytriclum, Marchantia), life cycle diagram, slides of moss life cycle stages
   4) Ferns -- representative slides (Christmas fern, walking fern, maidenhair fern), fern life cycle (including description)
   5) Gymnosperms -- representative slides (Gingko biloba, bald cypress, Douglas fir, white pine), slides of Austrian pine life cycle, schematic diagram of pine life cycle
   6) Angiosperms -- distinctive features, modifications, fruits (discussion includes slides), schematic diagram of life cycle stages
   7) Summary and overview -- five questions, advantages and disadvantages of haploidy and diploidy

5. Student Time: 90 minutes

6. Grade Level and Subject Area: Introductory Botany or Biology

7. Special Notes: Designed as lab replacement. This is an evolutionary presentation of the topic. Microfiche required.

1. **File Name:** bioindex-5a ecs: 4857
   DNA and Protein Synthesis

2. **Authors:** P. Tenczar and R. Baillie

3. **Instructional Objectives:** To discuss the process of protein synthesis. To order the protein assembly mechanism given three amino acids and corresponding m-RNA codes.

4. **Description:** Index (accessible through TERM-index)

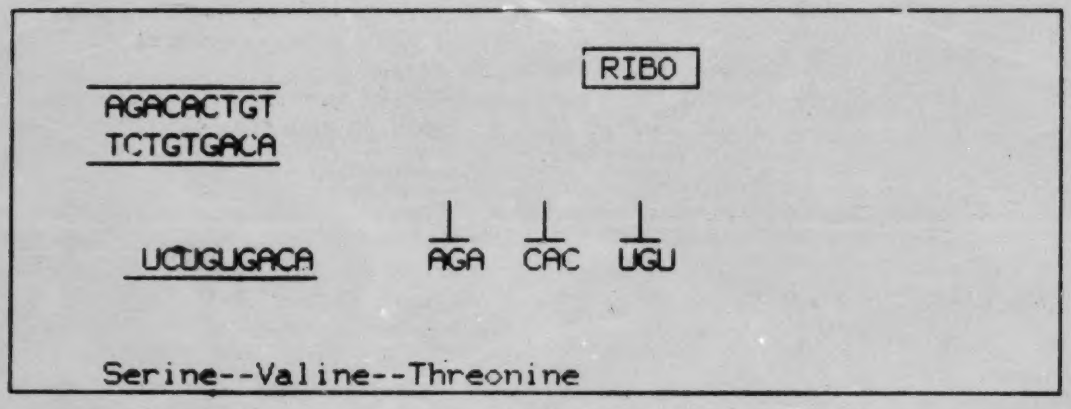
   1) Summary and introduction to DNA, RNA, the genetic code and protein synthesis
   2) Assemble the protein; given three amino acids and corresponding m-RNA codes, figure out the DNA and t-RNA codes

5. **Student Time:** 40 minutes

6. **Grade Level and Subject Area:** Introductory Biology

7. **Special Notes:** The introduction explains DNA, m-RNA, t-RNA, and the process by which nitrogenous base sequence of DNA molecules direct the construction of an amino acid sequence. There is an animation showing the construction of one such sequence. The student must assemble a polypeptide by specifying the needed parts (i.e., DNA, ribosome, etc.) as well as the proper nitrogenous base. Good review or supplement.

Add parts to the cell below to synthesize
this protein chain...
Serine--Valine--Threonine



What would you like to add?

1. File Name: bioindex-5b ecs: 5204
DNA, RNA, and Protein Synthesis

2. Author: R. Arsenty

3. Instructional Objectives: To distinguish the structure and function of DNA and RNA.
To construct the events of DNA replication and protein synthesis.

4. Description: No index

1) Discussion of DNA and RNA
2) Occurrences during cell division -- DNA replication animation
3) Occurrences between cell division
4) Supply correct base codes for DNA, m-RNA, t-RNA given amino acids and corresponding m-RNA
5) Assemble components in "model" cell

5. Student Time: 15 - 30 minutes (depends upon number of proteins assembled)

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: Participation in the assembly animation facilitates comprehension of the concept. A brief handout was designed to accompany this lesson but it is not required as it only reviews instructions supplied in the lessons.

1. File Name: bioindex-6a ecs: 4744
   Enzyme Experiments

2. Authors: R. Baillie and G. Hyatt

3. Instructional Objectives: To explain how and why environmental factors affect enzyme raction rates.

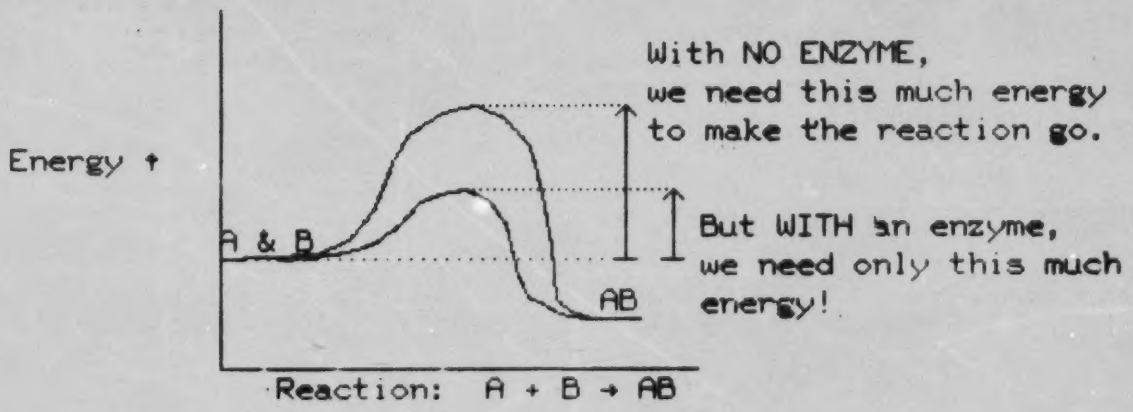
4. Description:

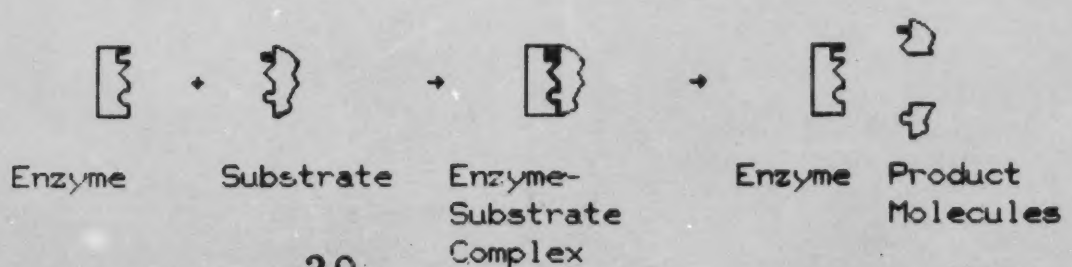
   1) Introduction -- lesson objectives, role of enzymes, how they work, animation
   2) Experiments chosen by the student
      a. Student varies pH, temperature, enzyme concentration or substrate concentration
      b. A specific substrate or enzyme is chosen
      c. Experiment run and reaction rates are observed
      d. Data and graph are presented with questions
   3) Nine review questions

5. Student Time: 30 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: This lesson allows for a variety of experimental conditions even if the student repeats an experiment, the values of the reaction rates are varied slightly from the initial experiment because a small amount of randomized "experimental error" has been built into the observed values of the reaction rates. Familiarity with enzyme structure is assumed.





1. File Name: bioindex-6b
   Essentials of Photosynthesis
   ecs: 1500

2. Author: R. Arsenty

3. Instructional Objective: To summarize the basic steps of the photosynthetic process and its relationship to respiration.

4. Description: No index

   1) Introduction
   2) The light reaction--the Z-scheme (refer to handout steps 1 - 6)
   3) The dark reaction
   4) Interrelationship of photosynthesis and respiration

5. Student Time: 15 - 20 minutes

6. Subject Area and Grade Level: Introductory Biology

7. Special Notes: A brief lesson concentrating on the Z-scheme with animation. The discussion of each step is included on a handout written by the author. Definitely requires prior preparation of student.

1. **File Name:** bioindex-6c ecs: 4344
   Photosynthesis

2. **Authors:** A. Haney and J. Noell

3. **Instructional Objectives:** To describe the relationship of leaf structure and function.
   To explain the principles of chromatography.
   To identify the fate of raw materials in photosynthesis.
   To explain varying photosynthetic efficiencies of plants.

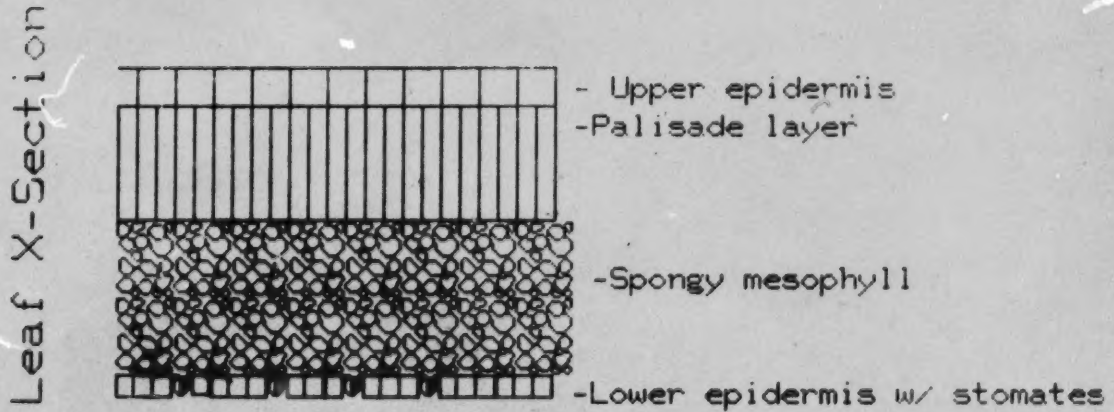
4. **Description:** Index (accessible through TERM-index)

   1) Introduction
      a. Requirements for photosynthesis -- student must supply
      b. Definition
      c. History -- one question
      d. Leaf structure -- diagrammed
   2) Pigments and chromatography
      a. Pigments involved and how
      b. Description of chromatography and time lapse scenario
   3) The photosynthetic process -- animated z-scheme
   4) The Calvin cycle
   5) Photorespiration (by J. Silvius) -- diagrams and graphs

5. **Student Time:** 40 minutes

6. **Grade Level and Subject Area:** Introductory Biology or Botany

7. **Special Notes:** Good overview of entire subject. Calvin cycle treated very briefly. Appropriate for review or lecture-lab supplement. Designed as introduction for bioindex-6d.



1. File Name: bioindex-6d ecs: 2288
   Experiments in Photosynthesis

2. Author: J. Noell

3. Instructional Objectives: To identify by various experimental procedures environmental factors which affect photosynthesis.
   To interpret data obtained from simulated experiments.

4. Description: Index (accessible through TERM-index)

   1) Light quality and plant growth -- select color, PLATO describes plant condition
   2) Dye reduction and Photosynthesis -- select wave lengths, PLATO reveals color and amount of dye reduction; graph of action spectrum
   3) CO_2 and light saturation of photosynthesis -- choose CO_2 concentration, enter light intensities, see graphical relationship, includes two questions

5. Student Time: 20 minutes

6. Grade Level and Subject Area: Introductory Biology or Botany

7. Special Notes: Designed as a lab replacement. Meant for use in conjunction with bioindex-6c. Assumes familiarity with spectrophotometer.

1. File Name: bioindex-6e
   ATP, Anaerobic Respiration, Aerobic Respiration, Electron Transport and Respirometer Experiment
   ecs: 4211 (sections 1, 2, and 3 only)

2. Author: R. Arsenty

3. Instructional Objective: To explain how energy for biological processes is obtained.

4. Description: Index (accessible through TERM-index)

   1) ATP
      a. Importance -- efficiency
      b. Structure
      c. Animated reaction -- ATP → ADP + energy + P_i
   2) Anaerobic respiration (glycolysis and fermentation)
      animation and summary
      explanation of steps appear on a handout
   3) Aerobic respiration (Krebs cycle)
      animation
      explanation on accompanying handout
   4) Electron transport chain -- see bioindex-6f
      four summary questions precede lesson in this sequence, handout accompanies also
   5) Respirometer experiment -- see bioindex-6g

5. Student Time: 30 minutes (sections 1 - 3)

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: For instructional purposes, must be accompanied by handout. However for review student could record off-line his or her description of events without necessitating handout. This series of lessons can be accessed together or used individually. Background and summary required, e.g., site of processes not localized within the cell, role of enzymes, etc.

1. File Name: bioindex-6f ecs: 1926
   Electron Transport Chain

2. Author: R. Arsenty

3. Instructional Objective: To calculate energy yield in ATPs per glucose during respiration.

4. Description: No index

   1) The electron transport chain includes:
      a. Animation of the ETC using 10 2H* from the Krebs cycle
      b. Tally of amount of H_2O and ATPs produced
      c. Four questions
   2) Eight questions on energy production in the respiration process
   3) Summary of energy production

5. Student Time: 15 - 20 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: Lesson refers to steps in a handout. The main index for the respiration series (see description for bioindex-6e) can be accessed by TERM-index.

   Requires prior preparation, e.g., no discussion of electron carriers themselves.

   This lesson assumes 3 ATPs are produced for each electron pair removed in the Krebs cycle. It does not account for the fact that only 2 ATPs are obtained from $FADH_2$; this accounts for the discrepancy in 38 ATPs and 36 ATPs accepted. Initially, origin of 32 ATPs is only apparent, but an additional 6 ATPs are accounted for at the end (4 from NADH in glycolysis, 2 from GTP in Krebs).

1. **File Name:** bioindex-6g **ecs:** 2856
   Measuring the Level of Life

2. **Author:** R. Arsenty

3. **Objective:** To calculate ATP production from volume of O_2 consumption obtained in simulated experiment with respirating peas.

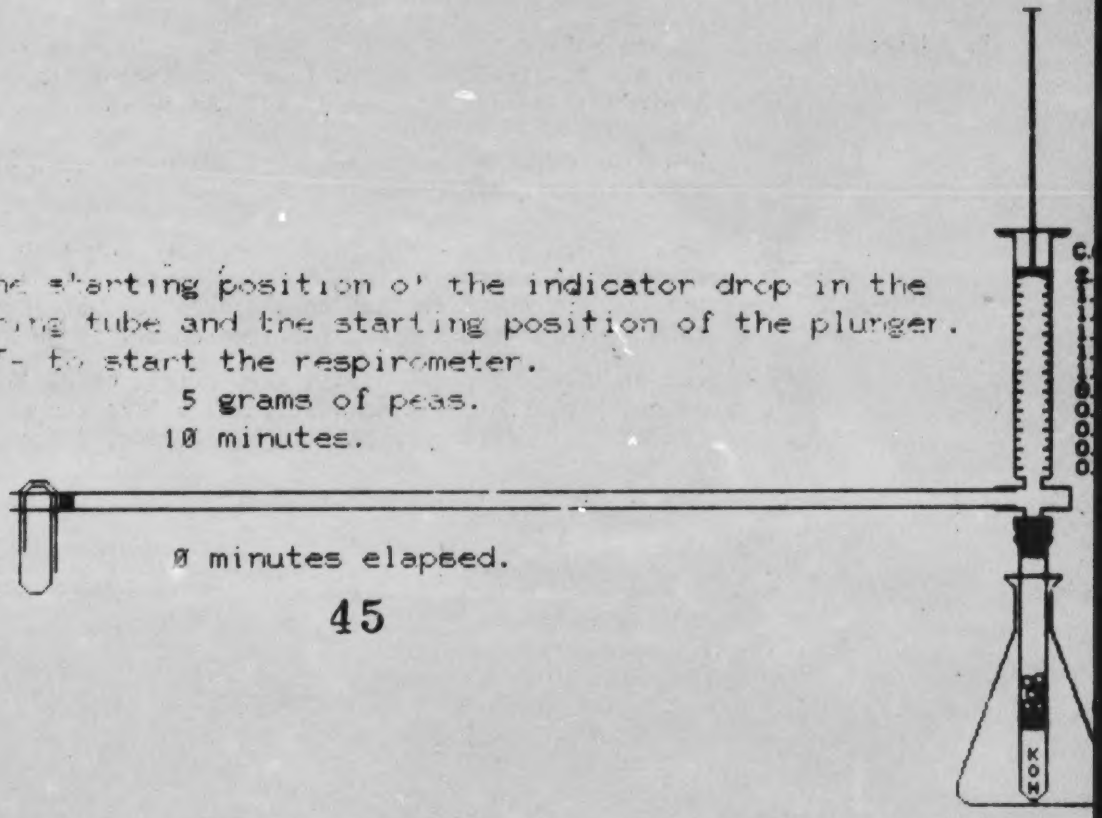
4. **Description:** No index

   1) Review of the respiration process
   2) Respirometer experiment
      a. Assemble parts for experiment
      b. Running the experiment
      c. Data collection
      d. Practice example for calculation of ATP production
      e. HELP sequence on scientific notation available via TERM-notation.

5. **Student Time:** 30 minutes

6. **Grade Level and Subject Area:** Introductory Biology

7. **Special Notes:** This lesson was designed as a replacement for a respiration lab. The main index for the respiration lesson series (bioindex-6e) can be accessed via TERM-index.


NOTE the starting position of the indicator drop in the long measuring tube and the starting position of the plunger.
Press -NEXT- to start the respirometer.
5 grams of peas.
10 minutes.
0 minutes elapsed.
45
KOH

1. File Name: bioindex-6h ecs: 2199
Respiration and Enzymes

2. Authors: J. Silvius and G. May

3. Instructional Objective: To describe the general scheme of glycolysis, Krebs cycle, and electron transport, especially the relationship of glycolysis to aerobic respiration.

4. Description: No index

1) Introduction
   a. ATP — the energy moledule
   b. Energy-requiring cell processes
2) Process of energy transfer to ATP reserves -- respiration in twelve steps
   a. Glycolysis -- diagram using C-skeleton for intermediates with description of events; question
   b. Additional requirements for aerobic respiration
   c. Krebs cycle -- diagram, explanation
   d. Electron Transport Chain -- effect of O_2 absence, CN poisoning, advantages of aerobic respiration

5. Student Time: 45 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: Designed as background for bioindex-6i.

The lesson derives 36 ATPs but not in conventional manner: it does not include the 2 ATPs obtained from GTPs in the Krebs cycle nor does it account for the 2 ATPs lost in transferring an electron pair from NADH in cytoplasm to $FADH_2$ in mitochondrion.

1. File Name: bioindex-6i ecs: 3215
   Experiments in Respiration

2. Authors: J. Silvius and G. May

3. Instructional Objectives: To explain dependence of mitochondrial activity and enzyme activity on temperature. To design an experiment to determine optimum temperature for activity.

4. Description: Introduction: Temperature in Life Processes
   Index (accessible through TERM-index)

   1) Experiment I: Effect of temperature on amylase activity
      a. Techniques for measuring reaction rate
      b. Experiment
      c. Analysis of results -- graphs, two questions
   2) Experiment II: Effect of temperature on respiration in isolated plant mitochondria
      a. Procedure
      b. Experiment
      c. Results, calculations, graphs
      d. A competitive inhibitor -- malonic acid
      e. A non-competitive inhibitor -- cyanide

5. Student Time: 30 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: Assumes familiarity with enzyme structure and nature of action, in addition to knowledge of standard curves and spectrophotometer.

1. File Name: bioindex-7a ecs: 4759
   Vocabulary Drills for Genetics (Part I)

2. Authors: J. Lendway and J. Sweany

3. Objective: To define common terms used in the study of genetics.

4. Description: The student chooses a category (a, b, c, or d). Each category consists of ten genetic terms (see list below).

   1) See list of words contained in category
   2) Complete or incomplete definitions appear sequentially, definitions often include descriptive diagrams
   3) Student supplies term or completes definition HELP available; must complete all without HELP to continue
   4) BACK accesses summary of terms with definitions that are completed.

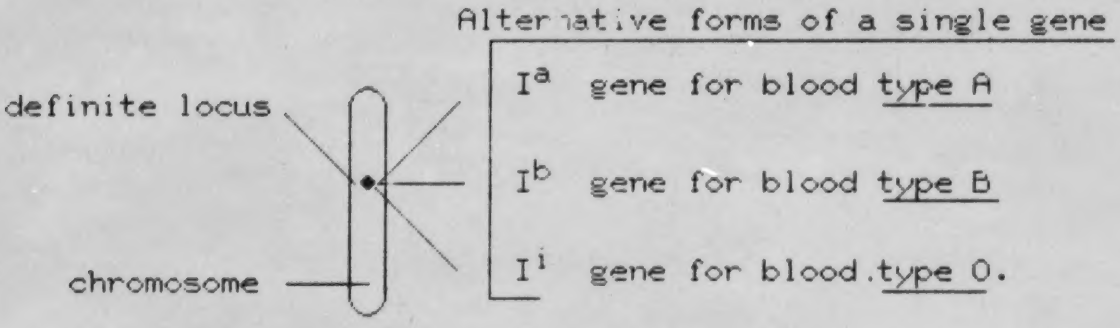
   Terms included:

a	b	c	d
hybrids	gamete	dominance	dihybrid cross
homologous chromosomes	phenotype	punnett square	crossing over
heterozygous	fertilization	probability	linkage
gene	zygote	recessive	recombinants
locus	law of segregation	monohybrid cross	autosomes
character	genotype	F_2	carrier
homozygous	genome	test cross	sex chromosome
genetics	meiosis	F_1	law of independent assortment
allele	diploid number	genetic probabilities	lack of dominance (codominance)
chromosome	haploid number	P	sex linkage

5. Student Time: 50 minutes

6. Grade Level and Subject Area: Introductory Biology, Genetics

7. Special Notes: Format enables flexibility in usage. The terms included in each category can often be identified with a common theme.


Alternative forms of a single gene
definite locus
chromosome
I^a gene for blood type A
I^b gene for blood type B
I^i gene for blood type O.

1. File Name: bioindex-7b ecs: 4197
   Vocabulary Drill for Genetics (Part II)

2. Authors: J. Lendway and J. Sweany

3. Instructional Objective: To define frequently used genetic terms.

4. Description: Index (accessible through DATA)
   The student chooses a category (a, b, c, or d). Each category consists of ten genetic terms (see list below). Format same as bioindex-7b.

   Terms included:

a	b	c	d
sex influenced traits	genetic interaction	hybridization	hemophilia
sex limited traits	polygenetic inheritance	deletion	Duchenne's muscular dystrophy
chromosome mapping	barr body	duplication	Huntington's chorea
backcross	expressivity	hybrid vigor	sickle cell anemia
trisomy	multiple alleles	mutation	Down's syndrome
pedigree	epistatic gene	inversion	Tay Sach's disease
non-disjunction	polyploid	germinal mutation	Tumer's syndrom
karyotype	complementary genes	translocation	Klinefeller's syndrome
reciprocal cross	epistasis	somatic mutation	outbreeding
crossover unit	penetrance	lethal gene	inbreeding

5. Student Time: 50 minutes

6. Grade Level and Subject Area: Introductory Biology, Genetics

7. Special Notes: Format enables flexibility in usage. The terms included in each category are often related in some way.

1. File Name: bioindex-7c ecs: 6012
   Elementary Probability and Mendel's Laws

2. Authors: R. Baillie and G. Hyatt

3. Instructional Objectives: To define probability.
   To demonstrate Mendel's laws.
   To manipulate probability problems and genetic crosses.

4. Description: Index (accessible through TERM-index)
   Introduction

   Part A. Probability -- includes working definition, simulations
   1. Coin tossing experiment
   2. Dice throwing experiment
   3. Calculating probabilities
   4. Summary of probabilities

   Part B. Heredity and genetics -- perform crosses, analyze results with Punnett square
   *5. Monohybrid crosses
   *6. Dihybrid crosses
   7. Heredity of human blood types (BACK accesses bioindex-7b)
   *8. Summary of heredity and genetics

   *also bioindex-7d

5. Student Time: 40 - 50 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: There is a handout to accompany this lesson. Requires brief introduction and summary without handout; lesson is useful as laboratory replacement.

1. File Name: bioindex-7d ecs: 3084
   Blood Typing

2. Authors: L. Porch and M. Yamada

3. Instructional Objectives: To learn the genetics of human blood types.
   To list steps in laboratory determination of blood types.

4. Description: Index (accessible through TERM-index)

   1) Introduction
      a. Objective
      b. Discussion of transfusions, antigens, antibodies, transfusion relationships, blood proteins
   2) Going to the storeroom (student requests needed equipment for experiment on blood determination)
   3) Going to the laboratory (student performs experiment using a patient PLATO provides and the equipment from the storeroom)
   4) Summary of blood types -- must find a blood type to see review questions, can repeat with new blood sample
   5) Four review questions

5. Student Time: 30 - 40 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: The lesson is designed so that the student has much flexibility. HELP is always available. Lesson can be accessed through bioindex-7a, #7.

The patient's finger has been disinfected. What next?

1. File Name: bioindex-7e ecs: 2499
   Genetics and Heredity

2. Authors: R. Baillie and G. Hyatt (edited for Introductory Botany by J. Noell)

3. Instructional Objective: To identify important principles of genetics concentrating on plants.

4. Description: Index (accessible only at the conclusion of a section)

   A. Heredity and Genetics
      1. Monohybrid crosses -- accounting for Mendel's laws
         a. Mendel's laws, sample cross F_1 and F_2 generations
         b. Terminology
         c. Punnett square -- monohybrid crossing problem for the student to solve
      2. Dihybrid crosses
         a. Deriving the phenotypic ratios of a dihybrid cross
         b. Sample dihybrid cross
         c. Student sets up crosses (can be done 0 → many times)
      3. Summary of heredity

5. Student Time: 20 minutes

6. Grade Level and Subject Area: Introductory Biology or Introductory Botany

7. Special Notes: Also parts 5, 6, and 8 of bioindex-7a. Very clear, concise lesson, good presentation of topic.

1. File Name: bioindex-7f ecs: 6201
   Drosophila Genetics

2. Authors: J. Denault, G. Hyatt, P. Tenczar, D. Eades

3. Instructional Objective: To deduce patterns of inheritance by simulating genetic crosses with Drosophila.

4. Description: Choice of crosses

   1) Monohybrid cross
   2) Dihybrid cross I
   3) Dihybrid cross II
   4) Sex-linked cross
   5) Mystery cross (one of the first four types of crosses)
   6) Chi-square statistical analysis (same as bioindex-1b)

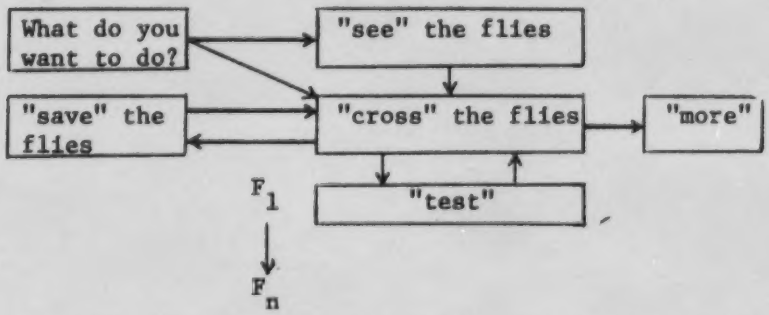
   At start of each unit the student is asked "What do you want to do?" Simulation allows six activities.

   "cross" -- mate two flies
   "more" -- get more flies from same cross
   "save" -- save flies by their number (1 - 18)
   "see" -- examine up to four flies
   "test" -- perform a chi-square test
   "mutant" -- see types of flies

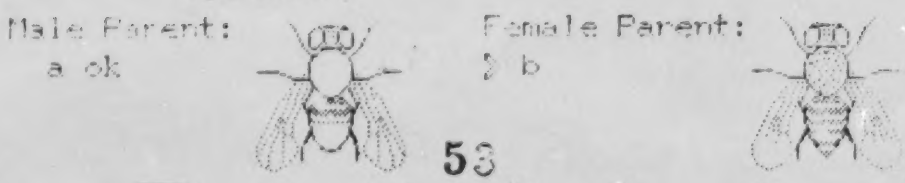
5. Student Time: 45 minutes (depends on the number of problems attempted)

6. Grade Level and Subject Area: Introductory Biology or Genetics

7. Special Notes: There is a laboratory manual available for this lesson. The manual consists of introductory and background material in addition to defined problems. This lesson requires such supplemental information whether by lecture or by handout. Some instruction in how to flowchart the activities would facilitate lesson usage.



Lesson assumes familiarity with principles of Mendelian genetics.



1. File Name: bioindex-7g ecs: 6594
   Gene Mapping in Diploid Organisms

2. Author: K. Frank

3. Instructional Objectives: To explain the process of crossing over.
   To calculate gene distances and order from crossover frequencies.

4. Description: Table of contents (only accessible at end of each section)

   1) Introduction — includes comparison of linkage and independent assortment
   2) Demonstration of the direct relationship between gene distance and the frequency of crossover -- twenty trials.
   3) Mapping two genes on a chromosome with sample problems
   4) Mapping three genes on a chromosome
   5) Procedure for determining the order of genes on a chromosome
   6) Determination of the coefficient of coincidence and interference
   7) Modifiers which affect crossover frequency
   8) Practice problems

5. Student Time: 60 - 90 minutes

6. Grade Level and Subject Area: Genetics or Introductory Biology

7. Special Notes: Very clear, concise presentation. First three sections particularly appropriate for introductory biology courses. Remaining parts are more advanced.

1. **File Name:** bioindex-7h ecs: 2129
   Plant Genetics Problems

2. **Authors:** J. Noell, G. May, A. Haney, and J. Silvius

3. **Instructional Objective:** To determine genetic composition of parents from progeny when one or two traits are involved.

4. **Description:** No index

   1) Albino-normal corn plant problem
      a. Data collection from monohybrid cross
      b. Chi-square analysis of data
   2) Dihybrid corn kernel problem
   3) Eight questions

5. **Student Time:** 20 minutes

6. **Grade Level and Subject Area:** Introductory Botany or Introductory Biology

7. **Special Notes:** This lesson assumes familiarity with basic genetics and requires much student interaction. Good sequel to bioindex-7e. Lesson designed as laboratory replacement.

Two corn plants were crossed and the resulting seeds planted. Here are the resulting plants:

If you use the symbols C and c, what was the genotype of the parents?
> Cc ok

Well done! Now let's see about a statistical test to validate your data! Press NEXT!

1. File Name: bioindex-7i ecs: 4505
Population Genetics (Demonstration of Inbreeding)

2. Authors: M. Grossman and D. Walter

3. Instructional Objective: To deduce how the degree of inbreeding affects the loss of heterozygosity.

4. Description: Table of Contents (accessible through shift-HELP)

1) Regular inbreeding system
   a. Choose inbreeding method -- choice of eight including selfing, brother-sister mating, etc. also may study differences between two breeding methods
   b. Designate number of generations to be used
   c. Enter initial level of inbreeding ($0 \leq N \leq 1$)
   d. Level of inbreeding in previous generation -- where applicable
   *e. Program generates graph of inbreeding coefficient vs. generations
2) Irregular inbreeding system
   a. Enter individual inbreeding -- create by mating existing members or specifying individuals from outside the breeding pattern
   b. Assign coefficient of inbreeding for starting generation
   c. Specify coefficient of relation
3) Lesson -- Hardy-Weinberg -- bioindex-7j
4) Lesson -- Quantitative Genetics -- bioindex-7k

*There are many options available from graphical displays, e.g., one may alter parameters, replot, clear, etc.

5. Student Time: Variable, 10 minutes - ???

6. Grade Level and Subject Area: Population Biology

7. Special Notes: Most of this lesson is somewhat advanced for the introductory student. However, the regular inbreeding simulation could be used on an introductory level. To manipulate the parameters effectively the student should know Wright's inbreeding coefficient, inbreeding methods and systems. Also to facilitate use of the simulation, the activities could be flow charted by the instructor. A handout is designed to accompany this lesson.

1. File Name: bioindex-7j ecs: 6627
   Population Genetics (Hardy-Weinberg Principle)

2. Authors: M. Grossman, D. Walter, D. Chirolas

3. Instructional Objective: To deduce the effects of mutation, migration, selection and drift on gene frequency.

4. Description: Table of Contents (accessible through shift-HELP)

   1) Calculator
   2) Mutation simulation
   3) Migration simulation
   4) Selection simulation
   5) General graphical simulation
      a. Choose axes
      b. Specify limits for plotting
   6) Sex linkage simulation
      a. Specify initial value of q for males and females
      b. Simulation assumes ten generations of breeding
   7) Simulation of genetic drift in small populations -- effect of random mating in a small population
      a. Choose size of population
      b. Select initial values of q
   8) Simulation of two locus effects -- simulates successive generations of random breeding large enough to avoid drift
      a. Specify gene frequency of populations or allow random generated frequencies
      b. Choose coefficient for probability of crossover
   9) Jumpouts to bioindex-7i and bioindex-7k

   Specify:
   a. limits for the generations used in simulation
   b. initial values of q
   c. frequency of A_2 allel for a single locus A with 2 allels A_1 and A_2.

5. Student Time: Variable, minimum of ten minutes depending on number of simulations

6. Grade Level and Subject Area: Population Biology

7. Special Notes: Assumes familiarity with Hardy-Weinberg principle and assumptions thereof. Preparation for the lesson should include a discussion of the mathematical representation $p^2 + 2pq + q^2$ and the meaning of these values. A handout is available. Parts of this lesson are adaptable to introductory courses.

1. File Name: bioindex-7k ecs: 2570
   Population Genetics (Quantitative Genetics)

2. Authors: M. Grossman and D. Walter

3. Instructional Objective: To deduce the effects of various selection methods and intensities on representative traits from agricultural production.

4. Description: Table of Contents (accessible through shift-HELP)

   1) Simulation of selection effects on various traits and selection methods
      a. Choose trait -- e.g., milk yield (kg) in dairy cattle, egg production (number) in chickens, or swine litter size (number of pigs)
      b. Designate selection for males and females -- single method or independent selection methods
      c. Choose selection system -- mass or individual, family selection, progeny testing, etc.
      d. Indicate genetic relationship -- where applicable
      e. Choose family size
      f. Choose selection intensities -- small and large populations
      g. Number of generations
      h. Program generates graph of improvement vs. generations
   2) Jumpout to Hardy-Weinberg lesson, bioindex-7i
   3) Jumpout to Inbreeding lesson, bioindex-7j

5. Student Time: Variable, 10 minutes - ???

6. Grade Level and Subject Area: Population Biology

7. Special Notes: Can be used very effectively to obtain data on the success of various selection procedures. Requires explanation of parameters in order to successfully manipulate these values to obtain meaningful data. A handout is available.

1. File Name: bioindex-8a ecs: 4508
   Natural Selection

2. Author: G. Hyatt

3. Instructional Objective: To summarize basic principles of natural selection and the genetics of populations.

4. Description: No index

   1) Introduction to natural selection
   2) Sample population of dogs -- population growth
   3) Questions
   4) Natural selection from reproduction and survival points of view
   5) Parental gametes -- Punnett square
   6) Hardy-Weinberg equation: gene frequencies and assumptions
   7) Experiment (field data provided) and data observation -- "tasters and non-tasters"
   8) Questions
   9) Model with natural selection -- background information on industrial melanism; simulated moth catching experiment (same as bioindex-8b)

5. Student Time: 50 minutes

6. Grade Level and Subject Area: Introductory Biology, Genetics, or Population Biology

7. Special Notes: Requires prior preparation of student.

1. File Name: bioindex-8b ecs: 5329
   Natural Selection Experiment

2. Author: G. Hyatt

3. Instructional Objective: To deduce principles of natural selection by observing survival rates of moth populations.

4. Description: No index

   1) Moth experiment introduction
   2) Genetics of the experiment
   3) Moth catching experiment (student must catch 10, 20, or 40 moths)
   4) Data analysis

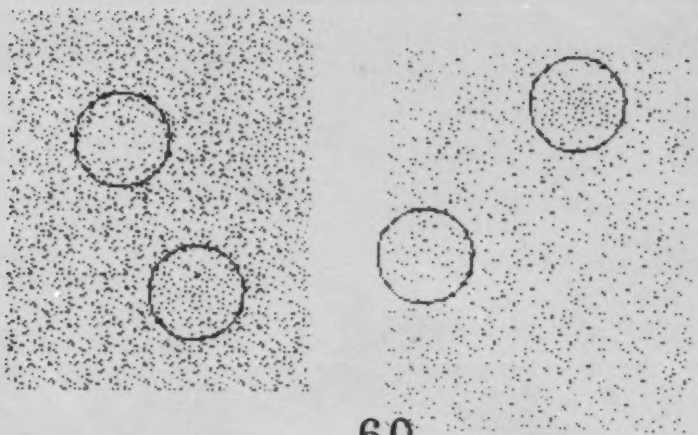
5. Student Time: 30 - 40 minutes

6. Grade Level and Subject Area: Introductory Biology or Evolution

7. Special Notes: This lesson does not access the background information on industrial melanism. A lab manual was designed to accompany this lesson. The lesson can be used with a touch panel, if available. In the event that a manual is unavailable, this lesson requires an introduction and explicit definition of problems for students to answer using the simulation. This is a sequel to bioindex-8a.

HERE ARE THE MOTHS AS THEY APPEAR

ON THE TREES....



1. File Name: bioindex-8c ecs: 3130
   Comparative Serology as Evidence for Evolution

2. Author: G. Hyatt

3. Instructional Objective: To describe how the precipitin test can reveal relationships between organisms.

4. Description: No index

   1) Introduction
   2) The precipitin test and homology
   3) The mammal experiment
      a. Student finds degree of relationship of different mammals on the basis of the precipitin test
      b. Summary
   4) The insect experiment
      a. Student finds degree of relationship of different insects
      b. Summary

5. Student Time: 30 - 45 minutes

6. Grade Level and Subject Area: Introductory Biology or Evolution

7. Special Notes: Without the lab manual designed to accompany this lesson, a brief introduction including definition of terminology and problem description is required.

1. File Name: bioindex-8d ecs: 3483
   Induced Mutations Experiment Using Aspergillus

2. Author: J. Noell

3. Instructional Objective: To describe a method to determine mutation frequencies.
   To calculate mutation rate.

4. Description: No index

   1) Introduction
   2) Life cycle of Aspergillus
   3) Experiment
      a. Tools of the experiment
      b. Questions to answer during the experiment
      c. Induced mutation flow chart
      d. Induced mutation experiment
      e. Calculations a - f

5. Student Time: 20 - 40 minutes

6. Grade Level and Subject Area: Introductory Biology or Introductory Botany

7. Special Notes: This lesson was designed as a lab replacement and requires summary remarks.

1. File Name: bioindex-9a ecs: 3522
   Biogeochemical Cycles

2. Authors: R. Baillie and G. Hyatt

3. Instructional Objective: To generate the four most important biogeochemical cycles.

4. Description: Index (accessible through TERM-index)

   1) Introduction
   2) Oxygen cycle
   3) Carbon cycle
   4) Nitrogen cycle
   5) Phosphorous cycle

5. Student Time: 20 - 30 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: For each cycle a list of the important parts of the cycle is provided. The student is required to give the sequence for each cycle (by answering questions of the nature "Where does it go from here?") and in doing so the entire cycle is diagrammed. An introduction and summary are recommended. Lesson traces elements within compounds -- not just pure molecular forms.

1. File Name: bioindex-9b ecs: 6552
   Energy Relationships in Biological Systems

2. Authors: R. Baillie and G. Hyatt

3. Instructional Objective: To know the basic laws of thermodynamics and how they apply to energy flow in biological systems.
   To measure efficiency of food chain.

4. Description: Index (accessible through TERM-index)

   Part A. First and second laws of thermodynamics
   1) Definitions and examples of energy and work; examples of conversion of energy
   2) The first law of thermodynamics (the law of conservation of energy)
   3) Illustrations of the first law: pulleys and weights, the pendulum
   4) The second law of thermodynamics: heat flow and equilibrium
   5) The second law: gas molecules, entropy, and randomness

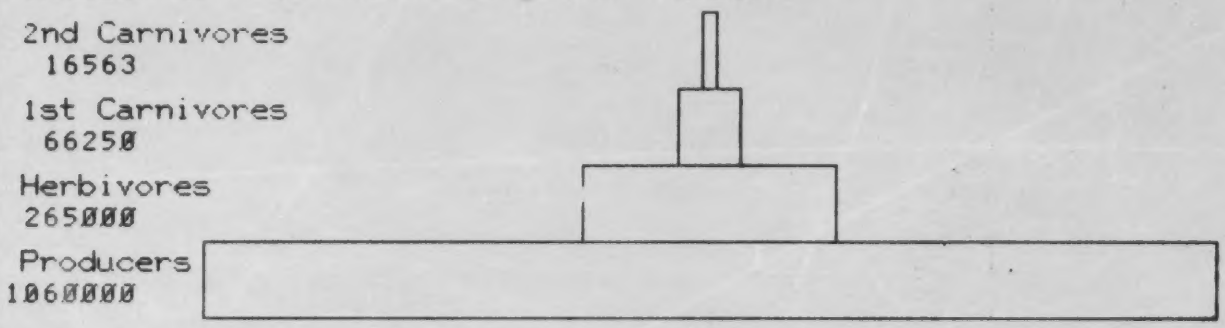
   Part B. Energy in biological systems
   6) Energy and biomass pyramids
   7) Summary of a simple food chain
   8) Finding the efficiency of a food chain
   9) Finding the producer biomass
   10) Other models of food chains: green plants; plants and herbivores; one predator, two prey

5. Student Time: 60 - 75 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: Comprehensive treatment of the concept.

CALCULATED Food Chain Using Your Value:



WE KNOW THIS:
Area = 1 square mile
Producer Biomass= 1060000 lbs.
2nd Carnivore biomass= 1411 lbs.

Your value of the ratio is: > .25 (2 decimal places)
Your value of .25 is too LARGE. Press NEXT to try again.

1. File Name: bioindex-9c ecs: 6150
   Predator-Prey Relationships

2. Authors: R. Baillie and G. Hyatt

3. Instructional Objective: To learn basic principles of predator-prey relationships from models of such systems.

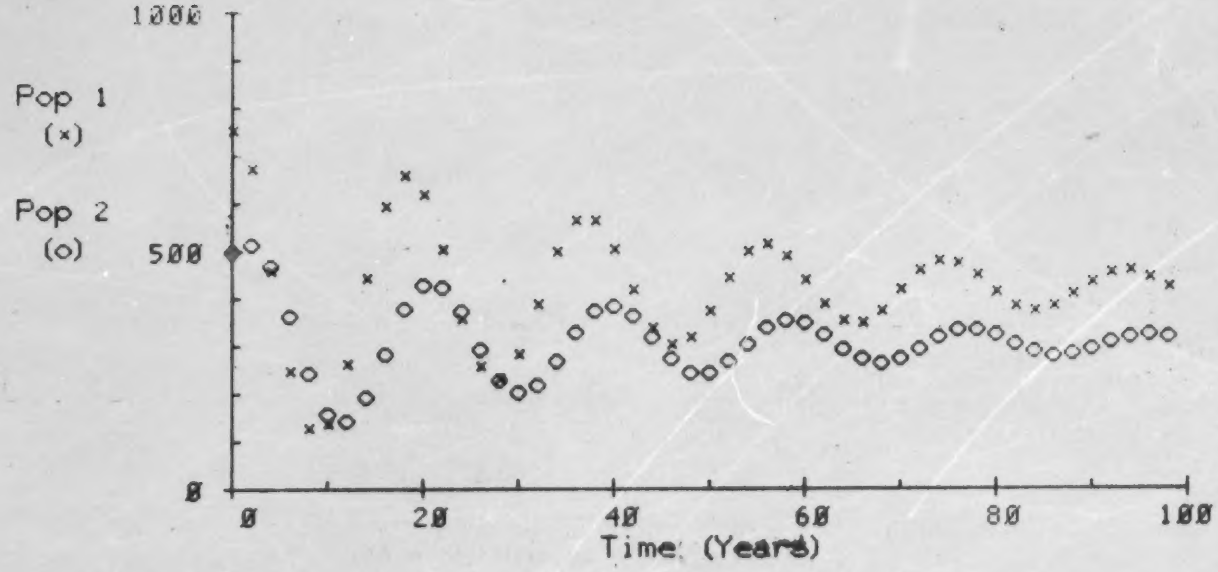
4. Description: Index (accessible through TERM-index)

   1) Competitive exclusion principle -- graphic representation
   2) Exponential growth -- growth in unlimited environment, graph
   3) Logistic growth -- growth in finite environment, LAB for experimentation with variables
   4) Predator-prey interaction: one predator, one prey -- graphs
   5) Mutual predation -- graph with independent experiment
   6) One predator, two prey -- graph with indendent experiment
   7) Prey density experiment -- grub catching concept (number caught depends on number available)

5. Student Time: 60 minutes

6. Grade Level and Subject Area: Introductory Biology and Animal Ecology

7. Special Notes: Lesson is fairly self-sufficient. Illustrates the dependence of population stability upon complexity.



1. **File Name:** bioindex-9d ecs: 3093
   Buffalo -- Animal Population Experiment

2. **Authors:** C. Burson and T. Gordon

3. **Instructional Objective:** To manage animal populations by altering a variety of parameters in a model.

4. **Description:** No index

   Introduction -- includes interpretation of population graphs

   1) Initialize herd population
      a. select total herd population or
      b. select individual population of adults, yearlings, and calves
   2) Select harvesting policies
   3) Summary of herd population and harvesting policies
   4) Experiment: graph and data

5. **Student Time:** 25 - 45 minutes (depending on how many experiments the student wishes to conduct)

6. **Grade Level and Subject Area:** Introductory Biology

7. **Special Notes:** This lesson has a lab manual to accompany it. In addition to a reiteration of that which is on-line, it includes a description of several problems. An orientation lecture could provide such guidance in the absence of a handout. The flexibility of the simulation enables much freedom for the instructor.

1. File Name: bioindex-9e ecs: 4012
   Population Dynamics

2. Author: S. Boggs

3. Instructional Objective: To describe the parameters of human population growth and how they affect changes in the population.

4. Description: No index

   1) Introduction -- enumeration of parameters
   2) Projections of population growth -- six options with parameters that can be altered
      for U.S.
         a. overall population in the future
         b. female population in the future
         c. male population in the future
         d. changes in the profile
      general
         e. population growth at some rate
         f. compare two growth rates

   HELP accesses additional instructional information as:
   a. meaning of the parameters
   b. what parameters to change
   c. what the graphs show
   d. meanings of some terms
   e. how the projection works

5. Student Time: 15 - 30 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: A handout has been designed by the author which defines several problems for the student that can be answered using this lesson. This information could be supplied in a supplemental lecture.

1. File Name: bioindex-9f ecs: 1500
   Populations Laboratory Using E. Coli

2. Author: J. Noell

3. Instructional Objectives: To describe how populations grow.
   To identify factors affecting the growth of bacterial populations.

4. Description: No index

   1) Introduction
   2) Population growth discussion with graphs -- semi-log and linear
   3) Environmental resistance -- density-dependent and density-independent
   4) Experiment -- student sets parameters (resistance type and severity), can repeat with different parameters and compare values on same graph
   5) Three questions

5. Student Time: 15 - 25 minutes

6. Grade Level and Subject Area: Introductory Botany or Introductory Biology

7. Special Notes: Designed as lab replacement.

1. File Name: bioindex-9g ecs: 2670
   Stationary Phase of Cell Growth

2. Authors: R. Francis with S. Kaplan and D. Burke

3. Instructional Objectives: To explain the growth curve in stationary phase and the relationship of the growth curve to viable cell count, total cell count, and cell mass.
   To differentiate between graphs of stationary phase caused by toxic products and nutrient exhaustion.
   To describe the effects of lysis and linear growth on cell growth curves.

4. Description: No index

   1) Stationary phase
      a. What it is
      b. What causes it
      c. Definition and problems with viable and total cell count, and cell mass
   2) Graphs of cells in stationary phase caused by toxic products and nutrient exhaustion
   3) Define lysis
   4) Define linear growth -- an animated comparison of linear and logarithmic growth

5. Student Time: 10 - 20 minutes

6. Grade Level and Subject Area: Introductory Microbiology

7. Special Notes: This is the fifth in a series of seven lessons on the phases of cell growth with particular attention to graphical analysis.

1. File Name: bioindex-9h ecs: 2333
   Lag Phase of Cell Growth

2. Authors: R. Francis with S. Kaplan and D. Burke

3. Instructional Objective: To explain the growth curve in lag phase.

4. Description: No index

   1) Characteristics and causes of lag phase
   2) Shift-up and shift-down
   3) Lag phase graphs

5. Student Time: 15 - 40 minutes

6. Grade Level and Subject Area: Introductory Microbiology

7. Special Notes: This is the seventh in a series of seven lessons on the phases of cell growth with particular attention to graphical analysis.

1. File Name: bioindex-9i ecs: 3466
   Death Phase of Cell Growth

2. Authors: R. Francis with S. Kaplan and D. Burke

3. Instructional Objective: To explain growth curve in death phase.

4. Description: No index

   1) Conditions that cause death phase
   2) Explanation of the formula $N_n = N_0 e^{-kt}$
   3) Death rate constant and some typical values
   4) A practical exercise determining canning times for cooked foods

5. Student Time: 15 - 25 minutes

6. Grade Level and Subject Area: Introductory Microbiology

7. Special Notes: This is the sixth in a series of seven lessons on the phases of cell growth with particular attention to graphical analysis.

1. File Name: bioindex-10a ecs: 3959
   Introduction to Seed Germination

2. Author: S. Wolniak

3. Instructional Objectives: To describe the processes of seed germination and seed dormancy.
   To define optimum conditions for seed germination.

4. Description: No index

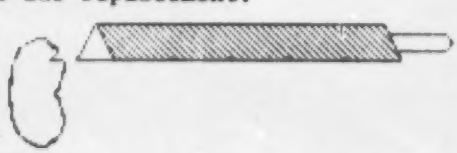
   1) Introduction -- HELP index
      a. Parts of a seed
      b. Fertilization
      c. First seed
      d. Anaerobic respiration
   2) Factors which control seed germination
      a. Water -- imbibition
      b. Oxygen
      c. Temperature
   3) Dormance in seeds
      a. Seed viability
      b. Historical background
      c. Storage of seeds
      d. Mechanisms of seed dormancy
   4) Experiment with lettuce seed germination
      -experimental variables-
      a. Photoperiod
      b. Hormones present
      c. Color of light used

   Note: Student must attain high percentage of seed germination in order to leave lesson.

5. Student Time: 30 - 40 minutes

6. Grade Level and Subject Area: Introductory Botany or Introductory Biology

7. Special Notes: An understanding of the respiration process and familiarity with plant hormones is recommended. Designed as lab replacement.



This is a Honey Locust Seed

1. File Name: bioindex-10b ecs: 2212
   Plant Growth

2. Authors: M. Manteuffel and J. Noell

3. Instructional Objectives: To explain the stages of sigmoid growth curve.
   To evaluate results of student growth experiments with corn, beans, and peas.

4. Description: Index (accessible through TERM-index)

   1) Growth curves
      a. The sigmoid growth curve and its phases
      b. Determinant and indeterminant growth
   *2) Observations on growth and development of corn and beans
   *3) Growth of peas in light and dark

   *These sections are ones in which the student uses data from plants grown at home.

5. Student Time: 20 - 30 minutes

6. Grade Level and Subject Area: Introductory Botany or Introductory Biology

7. Special Notes: This lesson is part of a series of growth and development lessons. It is self-explanatory and can be used independent of supplemental information.

1. File Name: bioindex-10c ecs: 3945
   Plant Responses and Apical Dominance

2. Authors: J. Noell and M. Manteuffel

3. Instructional Objectives: To explain the mechanisms of plant responses to light and gravity.
   To describe hormonal control of apical dominance.

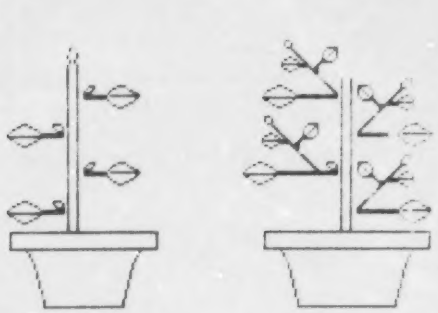
4. Description: Index (accessible through TERM-index)

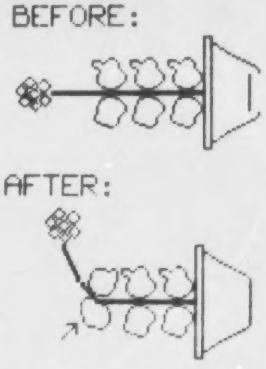
   A. Plant responses
      1. Phototropism
         a. Discussion
         b. Experiment -- coleoptiles and phototropism
         c. Questions
         d. The mechanism of the response
         e. Action spectrum of phototropism
         f. Review
      2. Geotropism
         a. Discussion
         b. Mechanism of the response
         c. Experiment using corn seeds and geranium plant
         d. Questions
   B. Apical dominance
      1. Introduction
      2. Experiment -- apex of plant removed and student replaces it with lanolin paste (with or without hormone) to determine what hormone(s) is (are) involved in apical dominance.
      3. Questions

5. Student Time: 30 - 40 minutes

6. Grade Level and Subject Area: Introductory Botany or Introductory Biology

7. Special Notes: This lesson is part of a series of growth and development lessons. Familiarity with plant hormones is recommended for lesson. Designed as lab replacement.





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1. File Name: bioindex-10d ecs: 2921
   Flowering and Photoperiod

2. Author: J. Noell

3. Instructional Objective: To explain the mechanism of flowering in response to light.

4. Description: No index

   1) Introduction
   2) Structure of the flower
   3) Alternation of generations -- the angiosperm life cycle
   4) Photoperiod -- chart hours daylight vs months (Champaign-Urbana, Winnepeg, Miami)
      a. Short-day, long-day, and day-neutral plants
      b. The discovery of photoperiodism
      c. The mechanism -- phytochrome red and phytochrome far red
      d. Questions on photoperiodism
      e. Experiment -- determination of photoperiod

5. Student Time: 30 - 45 minutes

6. Grade Level and Subject Area: Introductory Botany or Introductory Biology

7. Special Notes: Designed as a lab replacement. Part of the series of growth and development lessons.

1. **File Name:** bioindex-10e ecs: 1768
   Fruiting and Leaf Senescence

2. **Authors:** J. Noell and A. Haney

3. **Instructional Objectives:** To describe fruit formation, growth and maturation.
   To deduce physiology of leaf abscission from hormone experiments.

4. **Description:** Index (accessible through TERM-index)

   1) Fruiting
      a. Review of fruit formation
      b. Fruit growth -- measurement and graphing of tomato growth
      c. The fruit ripening process
   2) Leaf senescence
      a. Discussion of leaf abscission
      b. Experiment with leaves and hormones

5. **Student Time:** 15 - 20 minutes

6. **Grade Level and Subject Area:** Introductory Botany or Introductory Biology

7. **Special Notes:** This lesson is part of a series of lessons on growth and development. A familiarity with plant hormones and the angiosperm life cycle is recommended. This lesson designed as a lab replacement.

Here is a plant.
You may remove the leaf blade and leave it bare
or put a blob of lanolin (with or without a hormone)
on the petiole.

Choose a hormone or type in "plain".

>

1. File Name: bioindex-10f ecs: 2435
   Enzyme-Hormone Interactions

2. Author: J. Noell

3. Instructional Objectives: To deduce from a simulated experiment the effect of hormones on growth form.
   To determine the regulatory effect of enzymes on hormone levels.

4. Description: No index

   1) Hormones and growth form -- experiment with Alaska and Dwarf varieties of peas
   2) Assay for IAA Oxidase -- experiment

5. Student Time: 20 - 40 minutes

6. Grade Level and Subject Area: Introductory Botany or Introductory Biology

7. Special Notes: This lesson is designed as a lab replacement. Introductory material on plant hormones is recommended prior to student use. Included in the growth and development series.

1. File Name: bioindex-10g ecs: 4312
   Organization of the Higher Plant

2. Authors: A. Haney and G. May

3. Instructional Objective: To explain how each plant organ is specialized for its particular function.

4. Description: Index (accessible only at the end of a unit)

   1) Cytology quiz -- match organelles with functions
   2) Organs: leaf, stem, root
      a. Leaf -- variations in leaf forms, tissues, specializations, cross section lilac (Syringa)
      b. Stem -- function and specialization
         herbaceous -- monocot (Zeamays) and dicots (Helianthus, Medicago)
         woody (one year and three year Tilia)
      c. Root -- function and specialization
         monocot (Smilax)
         dicot (Ranunculus)
         branch roots
         meristem (Allium)
   3) Organization of higher plant
      a. Apical meristems -- longitudinal cross sections of Coleus and Elodea
      b. Hickory bud growth
      c. Phyllotaxy

5. Student Time: 45 minutes

6. Grade Level and Subject Area: Introductory Botany or Biology

7. Special Notes: Comprehensive presentation, designed as laboratory replacement. Lesson requires microfiche.

1. File Name: bioindex-11a ecs: 3029
   Plant Pathology: An Introduction to Disease and Koch's Postulates

2. Authors: J. Silvius and G. May

3. Instructional Objectives: To formulate a procedure for identifying the pathogen causing a disease.
   To calculate the dilution factor for making soil cultures.

4. Description: Index (accessible only at beginning of lesson)

   1) Introduction to Plant Pathology
      a. Purpose
      b. Terminology
      c. Three questions
      d. Examples (six slides) of diseases of plant parts
   2) Identifying the cause
      a. Procedure for determining what pathogen caused disease
      b. Student must evaluate postulates -- Koch's
   3) Culturing soil microbes -- simulation
      a. Preparation of a culture dish containing colonies growing in distinct regions
      b. Determination of number of spores and bacterial cells present in a sample of soil

5. Student Time: 40 minutes

6. Grade Level and Subject Area: Introductory Botany

7. Special Notes: Designed as lab replacement. Microfiche required for introduction (part 1).

1. File Name: bioindex-12a ecs: 3541
   Use of Taxonomic Keys

2. Author: J. Menney

3. Instructional Objectives: To construct a dichotomous key.
   To use a key to idenfity invertebrates.

4. Description:

   1) Part I -- Key construction
      a. Discussion of keys with example
      b. Dichotomy -- discussion and practice problem
   2) Part II -- Key use
      a. Illustration using invertebrate key
      b. Sixteen questions (student must tell what class a certain invertebrate is in)

5. Student Time: 20 minutes

6. Grade Level and Subject Area: Introductory Biology or Zoology

7. Special Notes: Would be helpful if student had some familiarity with organisms in the key as he or she is asked to key the organisms by their common names: (1) rotifer, (2) hydra, (3) jellyfish, (4) earthworm, (5) nightcrawler, (6) clam, (7) lobster, (8) oyster, (9) planaria, (10) aphid, (11) butterfly, (12) leech, (13) bloodsucker, (14) spider, (15) snail, (16) vinegar eel.

1. File Name: bioindex-12b ecs: 2220
   Plant Taxonomy

2. Author: A. Haney

3. Instructional Objectives: To recognize plant characteristics commonly used in vegetative keys.
   To learn to use a taxonomic key.

4. Description: No index

   1) Why should I study taxonomy? includes discussion of use of common names
   2) Features emphasized in vegetative key (slides)
      a. Leaves: form, parts, arrangement, types, four questions
      b. Twigs: buds, scars
   3) Example of key use from Botany 100 manual

   Student sent outside to key five labelled trees: two required, choose remaining three.

5. Student Time: 45 minutes

6. Grade Level and Subject Area: Introductory Botany or Biology

7. Special Notes: Designed as laboratory replacement; <u>microfiche required</u>.

1. File Name: bioindex-12c ecs: 2240
   Tree Identification Quiz

2. Author: A. Haney

3. Instructional Objective: To successfully key out five trees.

4. Description: Index

   1) Cercis canadensis (Red bud)
   2) Pseudotsuga menziesii (Douglas fir)
   3) Pinus strobus (White pine)
   4) Gleditsia triacanthos (Honey locust)
   5) Taxodium distichum (Bald cypress)
   6) Fagus sp. (Beech)
   7) Liriodendron tulipifera (Tulip poplar)
   8) Acer saccharum (Sugar maple)
   9) Platanus occidentalis (Sycamore)
   10) Taxus sp. (Yew)

   Trees are presented by number only. The student chooses tree number (five minimum) and records his/her identification. If identification is correct, one sees slide of tree. If not, student receives hints as to where she or he might have made a mistake in key.

5. Student Time: 15 minutes

6. Grade Level and Subject Area: Introductory Botany

7. Special Notes: Designed as lab replacement. Requires microfiche. Sequel to bioindex-12b. The key used is contained in the Botany 100 laboratory manual by A. W. Haney et al.

1. File Name: bioindex-13a ecs: 2697
   ADH and Water Balance in Humans

2. Author: R. Arsenty

3. Instructional Objective: To describe the homeostatic mechanism of water balance with reference to a variety of blood conditions.

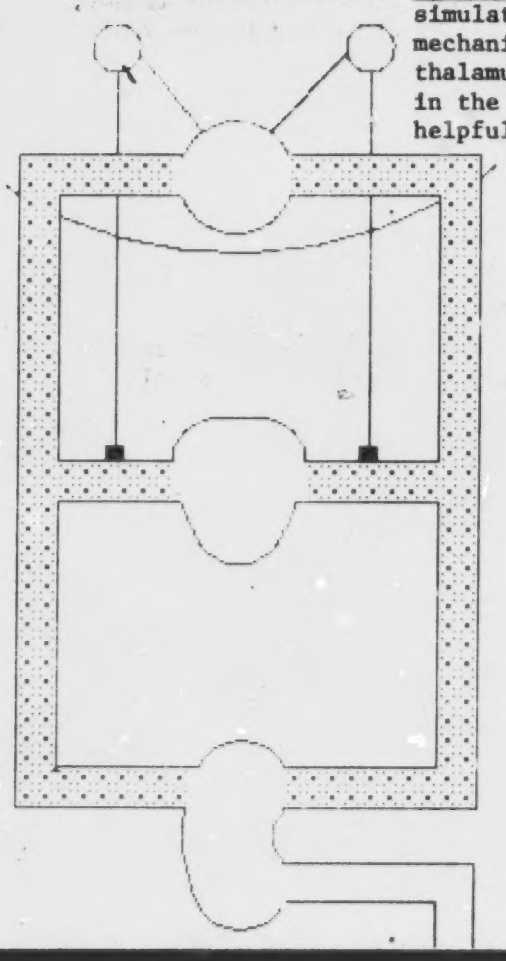
4. Description: Index (accessible through TERM-index)

   1) Introduction to ADH and water balance includes:
      a. A stylized model of human body showing hypothalamus, kidneys, circulatory system, and nerves
      b. How the homeostatic mechanism of water regulation operates
   2) Simulated experiment of water balance using the model -- student induces changes in water balance
   3) Ten questions based on information collected from the experiment

5. Student Time: 30 - 40 minutes

6. Grade Level and Subject Area: Introductory Biology or Introductory Physiology

7. Special Notes: There is a handout available for this lesson. This simulation enables the student to visualize a feedback mechanism. Some background information on the hypothalamus, anti-diuretic hormone, stretch receptors in the circulatory system and kidney function might be helpful in preparation for this lesson.



TYPE NUMBER, PRESS -NEXT- TO:
1) Drink large amounts of water
2) Sweat profusely
3) Cause massive bleeding
4) Drink large amounts of alcohol
5) Cause cancer of hypothalamus

X = blockage

= mass. blockage

= cancer

= normal blood

= dilute blood

= concen. blood

83

1. File Name: bioindex-13b ecs: 3441
   Neuron Structure and Function

2. Author: Steve Boggs

3. Objective: To explain neuron structure and function.

4. Description: Index (accessible through TERM-index)

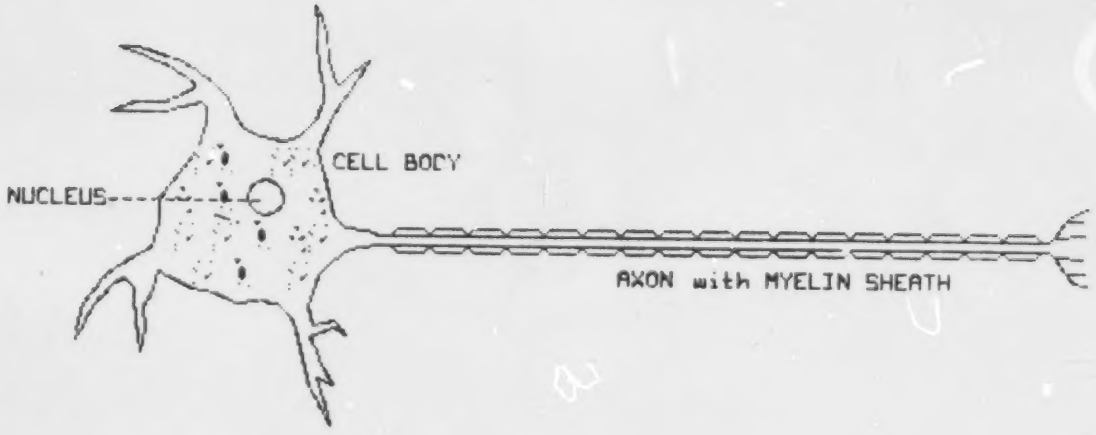
   1) The neuron -- structure diagrammed showing axon, myelin sheath, cell body, nucleus, terminal end, and dendrites
   2) Action potential -- shows simulation of impulse travelling across axon
   3) Threshold experiment
      a. Student given a particular neuron, and must determine its threshold stimulus by applying pulses of electric current
      b. Response graph given
      c. Data recorded for each trial
      d. Student concludes what threshold stimulus is
   4) The synapse -- discussion of synaptic transmission with animation with a discussion of the effects of poisons on neurotransmission
   5) Integration, includes a discussion of the reflex arc

5. Student Time: 30 - 45 minutes

6. Grade Level and Subject Area: Introductory Biology and Introductory Anatomy and Physiology

7. Special Notes: Comprehensive introductory treatment of subject.

the NEURON



1. File Name: bioindex-13c ecs: 6341
   Hormonal Control of the Menstrual Cycle

2. Author: Lee Porch
   revised by Community College Biology Group

3. Instructional Objectives: To identify anatomical features of female reproductive system.
   To relate the changes in female reproductive system to hormonal levels during the 28-day menstrual cycle.

4. Description: Index (accessible through TERM-index)

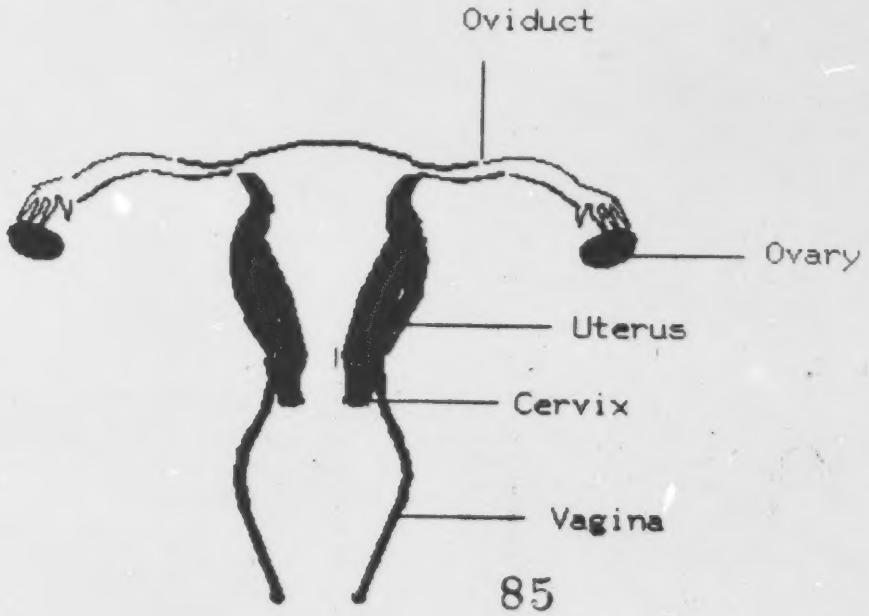
   1) Anatomical features of the female reproductive system -- discussion and questions, diagram
   2) Changes in the ovaries and uterus during the 28-day cycle -- animation and questions
   3) Hormonal changes during the 28-day cycle -- discussion and questions, table
   4) Review questions

5. Student Time: 60 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: Thorough subject treatment.

ANIMATION of CHANGES in the UTERUS and OVARIES during the 28-DAY CYCLE:



Press NEXT to start the animation.

1. File Name: bioindex-13d ecs: 5114
   Human Digestive System

2. Author: S. Boggs

3. Instructional Objectives: To identify the names of organs and structures of the human digestive system.
   To describe location of each of the above.
   To explain function each performs.

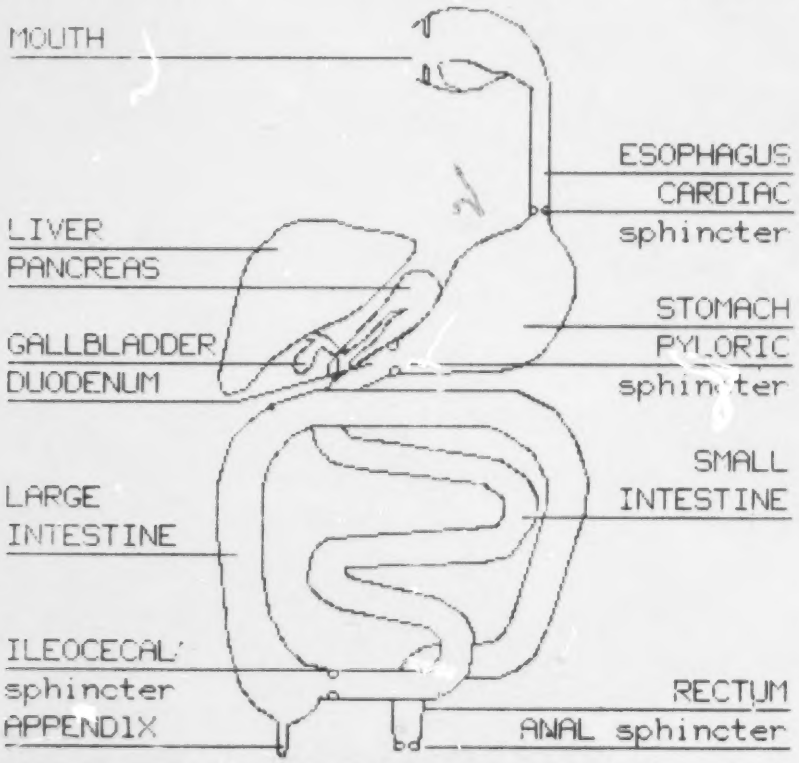
4. Description: Index (accessible through shift-BACK)

   1) Introduction
      a. Description
      b. Objectives
      c. Three questions
   2) Anatomy of Digestive System
      a. Schematic overview
      b. Organ by organ discussion of roles
         LAB accesses peristalsis animation
         DATA accesses sphincters animation
         Discussion includes six questions.
   3) Process of digestion
      Hydrolysis
      Table of enzymes and substrates (DATA)
   4) Given function, name the organ -- fourteen questions
   5) Five disorders of the digestive system

5. Student Time: 50 minutes

6. Grade Level and Subject Area: Introductory Biology, Anatomy and Physiology

7. Special Notes: Excellent introductory treatment of subject.



1. File Name: bioindex-13e ecs: 4746
   Cardiac Cycle

2. Author: F. Bomer

3. Instructional Objective: To explain the sequence of events which occur during a single heartbeat.

4. Description: Index (accessible through DATA)
   HELP accesses structural features of heart

   1) Pretest -- three questions, review if do not get all correct
   2) Introduction to cardiac cycle events -- valve action, pressure in heart chambers, animated heart
      DATA1 -- pacemakers
      systole - diastole
   3) The cycle in detail -- atrial and ventricular changes, schematic representation, summary of events of single heart beat
   4) Examination -- ten questions
   5) Student performance data

5. Student Time: 50 minutes

6. Grade Level and Subject Area: Anatomy and Physiology and Introductory Biology

7. Special Notes: This lesson is designed so that the student encounters questions with presentation of each new concept.

1. File Name: bioindex-13f ecs: 5578
   Heart Rate Regulatory Mechanisms

2. Author: F. Bomer

3. Instructional Objective: To describe the mechanisms which regulate heart rate.

4. Description: Index (accessible through DATA)

   1) Introduction with six questions -- compare skeletal and cardiac muscle
   2) Heart rate, Part 1 with five questions
   3) Heart rate, Part 2 with two questions
      a. Autonomous nervous system
      b. Nerves
   4) Stretch and pressoreceptors, includes seven questions
   5) Miscellaneous factors, includes five questions
      a. Emotions
      b. Temperature
      c. Hormones
   6) Test -- thirteen questions
   7) Student Performance Data

5. Student Time: 45 minutes

6. Grade Level and Subject Area: Introductory Biology and Anatomy and Physiology

7. Special Notes: High degree of student interaction. Good subject area coverage.

1. File Name: bioindex-13g ecs: 4556
   The Mechanics of Breathing

2. Author: F. Bomer

3. Instructional Objective: To describe the physiological and physical mechanisms governing breathing.

4. Description: No index

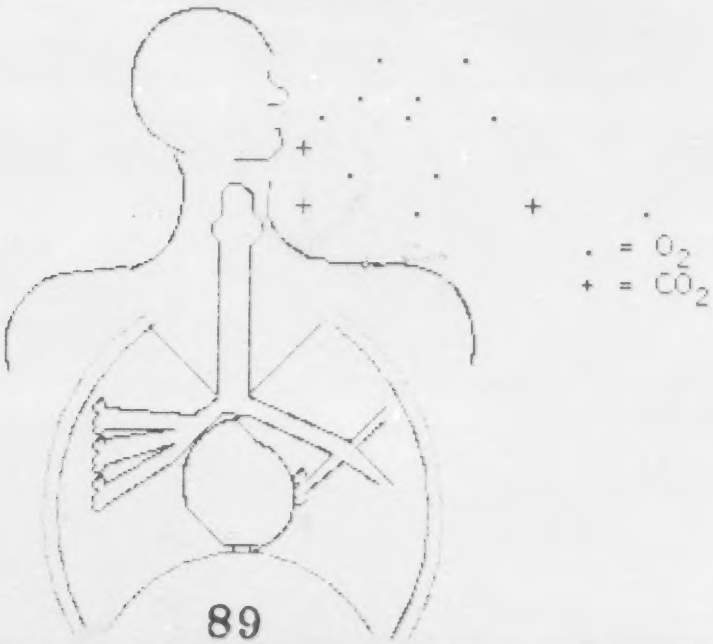
   1) Introduction
      a. Description and animation of process
      b. Relationship to principles of diffusion and osmosis
      c. Discussion includes questions
   2) Anatomy of beathing (with questions)
      a. Lungs
      b. Pleural cavity
      c. Path of gases
   3) Inspiration
      a. Muscular involvement -- animation
      b. Pressure and volume changes
      c. Questions throughout
   4) Expiration
      a. Muscular changes
      b. Pressur-volume changes
      c. Summary of expiration

      DATA accesses summary of inspiration
   5) Examination -- seven questions

5. Student Time: 50 minutes

6. Grade Level and Subject Area: Anatomy and Physiology and Introductory Biology

7. Special Notes: This lesson design is particularly effective because of the frequency that students encounter questions. The lesson is self-sufficient.



1. File Name: bioindex-13h ecs: 13245

2. Authors: M. Moore and P. McClintock

3. Instructional Objectives: To describe how sound is generated and characteristics of sound.
To relate ear anatomy to roles in hearing or balance.
To summarize common types of ear damage and means of preventing or overcoming such a situation.

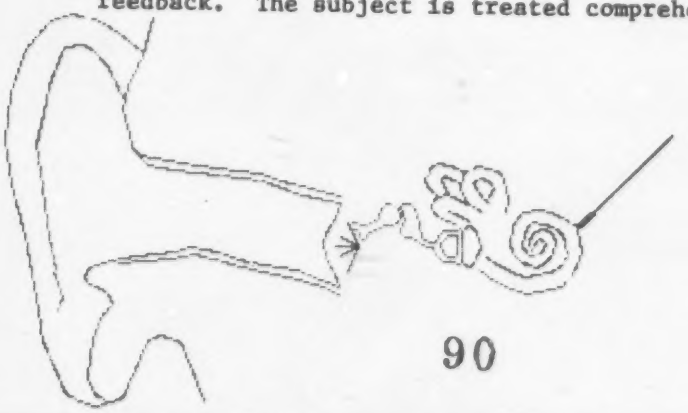
4. Description: No index

Introduction
1) Sound waves -- discussion includes diagrams and questions
   a. Characteristics of sound: pitch and loudness
   b. Review -- seven questions, cannot go back once started
2) Anatomy -- diagrams, questions, animations
   a. Structures
   b. Review -- twenty-two questions
3) Balance -- discussion includes diagrams and questions
   a. Semi-circular canals
   b. Inner ear
   c. Review -- seven questions
4) Degeneration of the ear
   a. Aging
   b. Bone conduction
   c. Ear drum puncture
   d. Hearing aids
   e. Surgery
   f. Eustachian tube
   g. Prevention
   h. Review
Final achievement test

5. Student Time: 90 - 120 minutes

6. Grade Level and Subject: Anatomy and Physiology

7. Special Notes: This lesson was designed for experimentation by the U.S. Army Research Institute. A few variables that will be manipulated are graphic emphasis and type of feedback. The subject is treated comprehensively.



1. File Name: bioindex-14a ecs: 3116
   The Physiological Basis of Learning

2. Author: S. Boggs

3. Instructional Objective: To explain the physiological nature of learning.

4. Description: Index (accessible through TERM-index)

   1) Thresholds and decision-making -- determining the path of an impulse, definition of learning, animation, questions
   2) The human cerebral cortex
   3) Models of brain function
      a. Dynamical -- connection established between neurons
      b. Plastic -- changes in thresholds
      c. Genetic determination
   4) Programming the cortex-o-matic
   5) Brain function -- reticular activating system

5. Student Time: 30 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: Lesson assumes familiarity with neuron structure and function. Introduction and summary by instructor are recommended. This simulation is helpful for visualizing events.

1. File Name: bioindex-14b ecs: 3520
   Simple Animal Behavior -- Klinokinesis

2. Author: G. Hyatt

3. Instructional Objective: To analyze data obtained in a simulation of one type of animal behavior.

4. Description: No index

   1) Importance of animal behavior
   2) Definition of kineses and taxes
   3) Sample klinokinesis experiment with worms -- includes questions
   4) Klinokinesis experiment with "bugs" -- student sets conditions (stimulus and animal properties), minimum fifty trials
   5) Chi-square test of data from experiment

5. Student Time: 30 - 45 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: This lesson has a brief lab manual consisting of tables to report data. The manual is not necessary for lesson use. Introduction and summary are required. TERM-reset allows one to perform chi-square test on the data anytime.

1. File Name: bioindex-14c ecs: 2421
   Social Behavior of Birds

2. Author: G. Hyatt

3. Instructional Objective: To deduce principles of personal space from lab simulations.

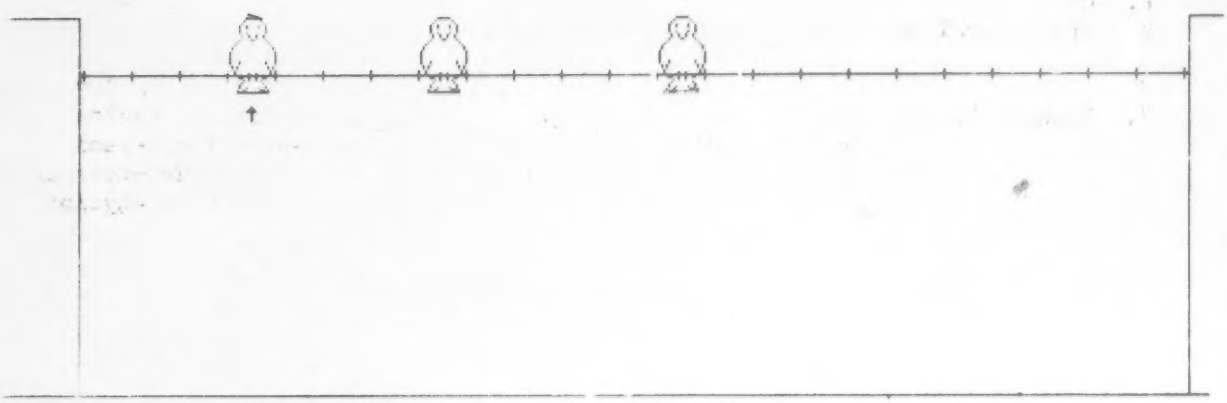
4. Description: No index

   1) Introduction to ethology -- types of behavior patterns
   2) Personal space -- experiment, data collection, and two questions -- must have 15 - 20 trials at each distance to proceed in lesson

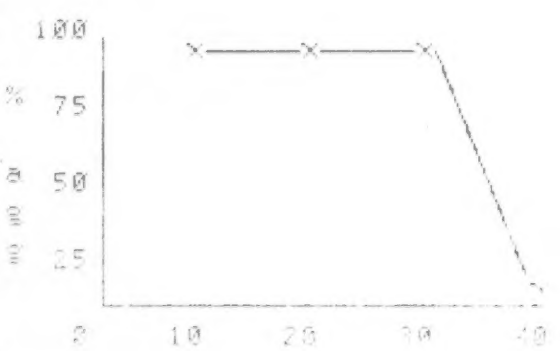
5. Student Time: 30 - 45 minutes

6. Grade Level and Subject Area: Introductory Biology or Ethology

7. Special Notes: This lesson is designed to be accompanied by a lab manual which contains specific problems for the student to answer using the program. It also contains tables for recording data generated by simulation.



Centimeters to intruder	No. of aggressions / # trials	% agg
10	2/ 2	100.0
20	2/ 2	100.0
30	1/ 1	100.0
40	0/ 1	0.0



ADDENDA

1. File Name: bioindex-1a ecs: 2506
   Introduction to the PLATO Keyset

2. Author: D. Kane

3. Instructional Objective: To learn to use those PLATO keyboard operations often required in lessons.

4. Description: Index (accessible through TERM-index*)

   0) Introduction
   1) NEXT key
   2) Arrows
   3) ERASE key
   4) EDIT key
   5) Keyboard (letters and numbers)
   6) SHIFT key (capital letters, etc.)
   7) BACK, HELP, LAB, DATA keys
   8) To go on with today's material

5. Student Time: 15 minutes

6. Grade Level and Subject Area: Science students

7. Special Notes: The student can either review the entire lesson or selectively examine parts with which he is unfamiliar.

*While holding the SHIFT key down, press the TERM ANS key, then type in the word "index".

1. File Name: bioindex-3e ecs: 4111
   Water Relations Laboratory

2. Author: J. Silvius

3. Instructional Objective: To learn a method for determining water potential of living cells.
   To describe the conditions which affect transpiration by manipulating a potometer.

4. Description: Index (accessible through TERM-index)

   1) Estimation of water potential (Ψw) of potato tuber cells
      a. Background -- technique
         Use cores of potato tubers, expose cells to solution with known solute potential (Ψs), determine initial and final weight
      b. Experiment -- to determine actual Ψw of potato tuber cells, calculate Ψw for one solution, get data for five more solutions, graph % change in weight vs. water potential (bars), answer questions
   2) Transpiration and water movement
      c. Background -- definition
      d. Experiment -- choose conditions, relative humidity, wind velocity, air temperature, light intensity, phenylmercuric acetate
         Includes three questions.

5. Student Time: 40 minutes

6. Grade Level and Subject Area: Introductory Botany or Biology

7. Special Notes: Designed as lab replacement sequel to bioindex-3d.

1. File Name: bioindex-13g ecs: 6159
The Mechanics of Breathing

2. Author: F. Bomer
B

3. Instructional Objective: To describe the physiological and physical mechanisms governing breathing.

4. Description: Index (accessible through DATA)

1) Introduction
   a. Description and animation of process
   b. Relationship to principles of diffusion and osmosis
   c. Discussion includes five questions
2) Breathing and body structure
   a. Lungs
   b. Pleura and pleural cavity
   c. Discussion includes four questions
3) Pressure and muscle action
   a. Path of the gases
   b. Ribcage, intercostal muscles, and the diaphragm -- animated
   c. Includes seven questions
4) The Process of inspiration
   a. Pressure-volume changes
   b. Includes six questions
5) The process of expiration
   a. Muscular changes
   b. Pressure-volume changes
   c. Summary of expiration
   d. Includes eight questions
6) Examination -- seven questions
7) Performance data

5. Student Time: 50 minutes

6. Grade Level and Subject Area: Anatomy and Physiology and Introductory Biology

7. Special Notes: This lesson design is particularly effective because of the frequency that students encounter questions. The lesson is self-sufficient.

1. File Name: bioindex-13i ecs: 4640
   The Heart: Structure and Function

2. Author: J. Cooper

3. Instructional Objectives: To describe the anatomical structure of the heart and its associated vessels.
   To describe the flow of blood through the heart.
   To understand the relationship of heart structure to its function.

4. Description: Index (accessible through DATA)

   1) Introduction
      a. Description of closed circulatory system
      b. Function of circulatory system with summary
      c. Components of circulatory system
      d. Five questions
   2) Anatomy of the heart -- includes questions, diagrams, animation
      a. Heart tissues
      b. Heart cavities
      c. Path of blood through the heart and associated vessels
   3) Posttest -- 24 questions
   4) Data on the lesson

5. Student Time: 45 minutes

6. Grade Level and Subject Area: Introductory Biology

7. Special Notes: Animated heart that appears in this lesson is also used in bioindex-13e and 13f.